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Enrichment of Yeast Leavened Bread by Pomegranate Bagasse Powder

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ABSTRACT

Pomegranate bagasse, a by-product of pomegranate juice industry, is a rich source of fiber and antioxidants. Dietary fiber regarded as ballast substance from vegetal foods, these days they are given increasing attention because of beneficial physiological effects that may exert on human. Pomegranate juice extraction bagasse which was obtained in two different ways: (i) Direct extraction that involved Arils and peels and (ii) only from Arils. Finely powdered pomegranate Arils Bagasse (AB) and Whole Fruit Bagasse (WFB) was incorporated into wheat flour for the development of value added bread. The feasibility of using pomegranate juice in the recipe was also checked. Basing upon the sensory attributes, 20% of both AB & WFB inclusion was optimized for bread preparation. It was observed that the optimized products showed variation in instrumental analysis, dietary fiber content & physical parameters in comparison to the control.

1.Introduction

The industrial conversion of vegetables and fruits generates large quantities of co-products rich in bioactive compounds that may well be suitable for other purposes [1].Fruits and vegetables co-products can be utilized for the manufacture of food ingredients, for example, protein isolates, polyphenols, and dietary fibers (DFs) [2]. Distinguished types of dietary fibers obtained from vegetables or fruits co-products, such as pea, apple, sugar beet, soy and citrus fibers, as well as inulin and gums, are now frequently included into foods for their nutritional or functional and technological properties [3, 4]. Pomegranate (Punicagranatum L.) fruit is considered to be a functional product of great benefit in the human diet [5]. Thearil comprises proteins, crude fibers, vitamins, minerals, pectin, sugars, polyphenols[6],utilized often in popular pomegranate products such as canned beverages, jam, jelly, paste [7] and fresh juice which can be obtained from the arils or the whole fruit.After the extraction of juice,there remains a waste composed mainly of pulp and bagasse-utilization of whichislimited and their disposal constitutes a problem.Re-use of the pomegranate bagasse obtained from the pomegranate industries can avoid this problem. The large quantity of potentially beneficial compounds such as dietary fiber or bioactive compounds mainly phenolic acids and flavonoids which could be used as ingredient in food processing. Pomegranate bagasse powder co-products can be included in products requiring hydration, viscosity development, and freshness preservation, such as baked foods or cooked meat products. [8].Bakery foods are the major cereal products available to consumers and bread has been the principal food in over half of the countries around the world [9].Many alternatives for wheat flour as a substitution or replacement in yeast leavened bread making are being exploited or thought of in recent times.

The present investigation was undertaken to study the feasibility of pomegranate bagasse powder inclusion and to check the crude fiber content, textural, organoleptic and physical properties of breads prepared.

2. Materials and Methods

2.1Materials

Fresh and good quality ripened pomegranate fruits of Bhagawa-variety andthe ingredients used for bread making (i.e. refined wheat flour, sugar, yeast, salt) were procured intermittently from local market throughout the work period.

2.2 Preparation of pomegranate bagasse powder

To obtain pomegranate juice & arils bagasse (AB) the pomegranate fruits were peeled manually and the arils were introduced in a blender (model no.: PHB 6, Prestige blender, India) to obtain pomegranate juice and the bagasse separately. Muslin cloth was used for the separation [8].

To obtain whole fruit bagasse (WFB) the pomegranate fruits were cut in half and squeezed in a juicer to obtain pomegranate juice and the bagasse separately. The bagasse mixture in muslin cloth was dipped in water with constant temperature of 75^{0}C for 10 mins in a beaker. The whole co-product was pressed to drain the liquid waste after washing process [8].

The AB & WFB were then dried at 60°C for 8 hours in hot air oven on a flat stainless steel tray before grinding the dried samples with a grinder mill and sieved to obtain a powder particle size of less than 0.500mm.

2.3. Bread making with AB & WFB flour substitution

Bread wasprepared by straight dough method [10]. AB & WFB flour replaced the wheat flour at 15%, 20% & 25% levels andthe water portion in bread recipe was replaced by the pomegranate juice.

2.4.Evaluation of bread quality

2.4.1.Evaluation of bread volume

Volume of the bread was determined one hour after the end of baking process using the formula:

Specific volume (cm^3/g) = Volume of bread (cm^3) / Dough weight (g). After weighing, the volume of the sample was measured by the method of displacement of millet seeds [11].

2.4.2. Bread sensorial evaluation

For sensory evaluation, the attributes for determining the consumer acceptability of the breads were based on overall external appearance and taste: color, texture, aroma, taste, overall acceptability. Panelists were asked to evaluate the above attributes of the samples and to rate each attribute on a scale from 1(dislike extremely) to 9(like extremely) using nine point hedonic scale [12]. This experiment was done in a controlled environment, with proper ventilation.

2.4.3. Estimation of crude Fiber content.

The products of AB bread and WFB bread were analyzed for crude fiber content with the help of Fibraplus (FES 06 model, Pelican equipments) instrument. The tests were conducted in triplicate.

2.4.4. Texture profile analysis (TPA)

The TPA test consists of compressing a 1 cm thickness bread slice two times in a reciprocating motion that imitates the action of the jaw. The texture of each slice of bread was analyzed using P/75mm compression platen in Texture Analyzer (Stable Micro Systems, Surrey, UK).The bread slice was placed on the heavy duty platform and the test speed was set to 10mm/sec and the probe compressed 50% of the bread to get the TPA of the bread. Based on the force deformation curves, several parameters like gumminess, springiness, cohesiveness, chewiness and resilience can be calculated.

The testing was performed in triplicate, and the force recorded in grams.

3. Results and Discussion

3.1. Effect of AB & WFB Level on bread volume

The specific volume of the breads prepared from WFB showed lesser specific volume in comparison to the control (100 % wheat flour bread). Various investigationsreport that there is a decrease in wheat bread specific volume upon addition of insoluble fibers, such as hulls, sugarcane bagasse, carob [13-16]. A possible reason is that fiber interacts with gluten and lead to a decrease in the gas retention capacity. (**Table 1**).

Table 1. Influence of increasing AB & WFB level on crude fiber content, sensory& physical parameters

Details	Crude fiber content (g/100g of bread sample)	color	texture	taste	aroma	Overall acceptability	Specific volume (cm3 /g)
Control +juice 0g/100g	3.4±0.1	8.8±0.11	8.4±0.13	9.0±0.11	7.4±0.07	8.8±0.08	2.9±0.8
	AB Level (%)						
15g/100g	4.1±0.3	7.4±0.11	6.6±0.08	7.6±0.00	8.0±0.09	7.6±0.05	2.6±0.2
20g/100g	4.6±0.5	7.6±0.06	6.0±0.05	7.5±0.11	8.0±0.11	7.5±0.08	2.3±0.6
25g/100g	4.9±0.1	7.8±0.13	6.0±0.04	7.4±0.15	7.8±0.07	7.2±0.10	2.1±0.1
	WFB Level (%)						
15g/100g	6.8±0.0	7.4±0.05	6.2±0.13	7.2±0.10	8.0±0.06	7.5±0.00	2.5±0.1
20g/100g	7.0±0.6	6.8±0.05	6.0±0.11	7.0±0.07	8.0±0.09	7.4±0.10	2.2±0.1
25g/100g	7.3±0.8	6.8±0.05	5.8±0.05	7.0±0.04	8.0±0.08	7.0±0.13	1.8±0.0

3.2. Influence of increasing AB & WFB level on sensory parameters

For the overall acceptability parameter, the scores given by the panelists ranged from 8.8 to 7.0, which is quite in the acceptable range (**Table 1**). The color and sweet aroma of pomegranate juice was highly appreciated and accepted by the panel members. In all the parameters there was not much difference between control and other samples. The texture, taste, & aroma were acceptable by the sensory panelists **(Figure 3.)**. **(Figure 1 about here)**

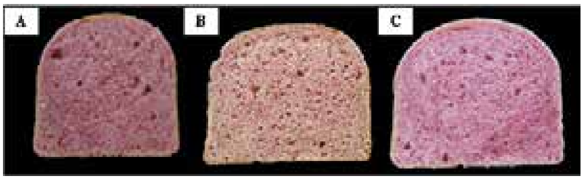

Figure 1. A-Slices of 20%AB bread, B-Slices of 20% WFB bread, C- Single slice control with juice bread

3.3 Estimation of Crude Fiber content

The AB & WFB are a rich source of dietary fiber as mentioned earlier [8]. It was noted that there was a substantial increase in the fiber content in bread with incorporation of pomegranate bagasse powders (**Table 1**). The control bread made with pomegranate juice was also investigated which showed an increase in the fiber content which can be accounted as the soluble fibers present in the juice. Apart from this, as expected, there was an enhancement in the fiber content with the increase in the level of incorporation of the pomegranate bagasse. The AB incorporated breads showed less dietary fiber amount in comparison to the breads made with WFB perhaps because during the extraction of WFB, part of the peel was included into the bagasse. Hence extracts rich in fiber obtained from pomegranate fruitscan be utilized as functional ingredients because they provide numerous health benefits such as their ability to decrease cholesterol levels, improve glucose tolerance and the insulin response, reduce hyperlipidemia and hypertension,and contribute to gastrointestinal health and the prevention of certain cancers such as colon cancer [17]. **(Table 1 about here)**

3.4. Influence of incorporated AB & WFB at 20% level on the texture profile of the breads

From the sensory tests and specific volume calculations it was seen that breads made with either AB or WFB up to a level of 20% gave acceptable results whereas the higher levels exhibited negative effects on the physical parameters of the bread and henceforth 20% level was selected as the level of inclusion for both AB & WFB. Thus the texture profiling was done for these optimized samples and the results are tabulated in **Table 2**.

The hardness of the bread varies due to the variation in the substitution of the different ingredients. Higher the force shows that harder is the bread.

The gumminess may be due to the gelatinization and more fluidity of wheat gluten structure in the cooked samples.In the current study since the dough consisted of coarser particles and cooking time was constant the gumminess must be due to the ratio of wheat flour: sample powders and pomegranate juice and the quality of the ingredient.

Lower resilience value shows that the product can recover faster from deformation proving the firmness of the product. Henceforth the data revealed that AB bread is more firm. **(Table 2 about here)**

Table 2.Influence of incorporated AB & WFB at 20% level on the texture profile of the breads

Details	Hardness	Springiness	Cohesiveness	Chewiness	Gumminess	Resilience
Control	2390.67	0.99	0.87	1137.25	1325.28	1.22
Control with Juice	2291.47	0.99	0.86	1233.90	1766.66	1.30
20%AB	1977.67	0.99	0.71	1349.25	1364.85	1.01
20%WFB	12199.10	0.99	0.73	1243.95	1679.22	1.13

4. Conclusion

The substitution of wheat flour by AB & WFB resulted in the enhancement of fiber content in the blends. From the above study it can be concluded that although the breads with higher level of incorporation gave better fiber content results, but received lower scores in the sensory tests. From the sensory tests and specific volume measurements it was seen that breads made with either AB or WFB up to a level of 20% gave acceptable scores whereas the higher levels exhibited deleterious effects on the physical parameters of the bread and henceforth 20% level was optimized as the level of inclusion for both AB & WFB. According to the texture analysis, 20%WFB blended breads gave harder breads with coarser particles than the 20%AB blended breads.

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