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Development of value added Bread using Amala Pomace Powder and its Nutritional Evaluation

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Abstract

Amala pomace (AP) is a by product of amala juice processing industry. It contains large amounts of dietary fiber and other valuable compounds. Drying increases shelf life of AP. Consumption of bakery products increasing. But that contain negligible fiber therefore, continuous consumption may lead to major chronic diseases. Bakery products are easily modified into therapeutic products. Therefore, the present study was planned to develop bread utilizing AP and evaluate its nutritional composition. For that, AP was dried, ground, sieved to 240µ (APP), packed in polythene bag and stored until used. For product optimization Maida was replaced with 1, 3, 5 and 7% APP in the commercial bread formula and evaluate sensorily (6 panelists X 3 times) using 9 point hedonic scale. The processing changes include increased proofing temperature and decreased time and vice-a-versa in baking. The sugar level was increased to 10% in the formula. 5% APP replacement resulted into pour volume & texture. Thus APP replacement level narrowed down to 1, 2, 3 and 4% for primary selection and 1, 1.5, 2 and 2.5% for final selection using composite scoring test. The 2% APP replacement scored the highest. That is considered as Experimental Bread (EB). A consumer survey showed that 77.88% liked EB. Raw material, control and experimental bread were analysed for various nutrients using standard methods. The protein of APP found about one fourth as compared to Maida. The APP contained 17.87% and 2.75% fiber and mineral, respectively. EB contains 11.43% more fiber and 1.56% more minerals then CB.

Keyword: Health food; Bread; Amala Pomace: Fiber.

Introduction

Demand for the medicinal plants is increasing in both the developing and developed countries due to a growing health consciousness. Amla fruit (*Emblica officinalis*), known as Indian Gooseberry, is widely cultivated in India and is is one of the most frequently used Ayurvedic herbs in the traditional Indian medicine[3]. Amala pomace, a by product of amala juice processing industry, contains large amounts of valuable compounds including dietary fiber. Thus could be explored in the development of food ingredients and dietary supplements[1].Bakery products bear negligible fiber therefore its continuous

consumption may lead to chronic diseases. Increasing health consciousness and easy modification of bakery products has led to their development as therapeutic products[4]. A few authors used amala pomace to develop bakery products. Therefore, a study was planned to develop the amala pomace powder bread on the sensory characteristics. The nutritional composition of bread was studied.

Materials and Methods

Preparation of Amala Pomace Powder

Amala pomace produced as byproduct after juice extraction as a part of experiential learning for the students for commercial purpose was collected from the Center of Fruit Processing, Department of Horticulture, B A College of Agriculture, Anand Agricultural University, Anand, Gujarat, India. For juice extraction, amala (Anand-1) variety was obtained from the university farm, sorted, cleaned with water, blanched and juice extracted in centrifugal juicer. The pulp left was dried and converted to powder as shown in Figure 1 and used for further analysis and product development.

Product Development

Bread was developed in the laboratory following scientific method as detailed below.

Recipe Optimization

Good quality raw materials, except APP, were purchased from the local market, cleaned, packed in airtight PET jar and stored at refrigeration temperature until used. Bread was prepared by replacing APP at different levels to Maida in the commercial bread formula using no dough time method of bread bred preparation[5]. Repeated trials with changes in quantity of raw materials (yeast, water and acetic acid) as well as processing conditions (time and temperature for proofing and baking) were carried out to standardize the recipe. The formula was also changed as per the panelists' suggestions.

Sensory Evaluation

Recipe optimization was carried out on the bases of sensory evaluation using three steps namely preliminary trials, primary selection and final selection. The preliminary trials were scored on the bases of nine point hedonic scale[6] were as for primary and final selection composite scoring test was used [7]. The breads prepared using the adopted formula were sliced, randomized and presented to the panelists for evaluation of sensory characteristics. The breads were evaluated for acceptability by 6 members X 3 replications on the day of preparation. For this, products were served on randomly coded paper plates at room temperature. Panelists were supplied with tap water for cleansing the palate between samples. Product evaluation was carried out under 'day light' illumination and in isolated booths within the laboratory. The panelists evaluated volume, colour and nature of crust, symmetry of shape and uniformity of bake, texture and grain, crumb colour, taste and aroma and overall acceptability.

Bread prepared using the commercial formula (i.e. 0% APP) served as the control bread (CB) and was used for comparison. The sensory scores assigned by panelists were analysed statistically. The bread that scored the highest among APP incorporated bread was selected for further refinement i.e. from preliminary to primary and followed by final selection. Replacement rate of APP was narrowed down in such a way that percent replacement of APP of "selected product" remains some were in the middle. At the time of final selection, the bread ranked highest overall acceptability among APP incorporated bread was considered as the Experimental Bread (EB) and used for subsequent study.

Consumer Survey

Once after evaluation by experts the consumer survey was carried out through sensory evaluation using five point hedonic scales. Total 200 respondents from among faculty members of Anand Agricultural University were randomly selected. Out of that 113 respondents assigned their selection. The samples were provided almost in similar fashion to preliminary screening at a time of meeting.

Nutritional Evaluation

Maida, APP, CB and EB were analysed for various nutrients namely moisture, protein (macro-Kjeldahl method), fat (soxhlet method), carbohydrate (anthrone method), energy (calculated), fiber (by digestion) and ash (muffle furnace burning) using standard methods.

Data Analysis

The standard SPSS program was run to analyse the data. All the data were tested for significance using the ANOVA / Duncan's test[9].

Results and Discussions

Present study was planned to develop value added bread using APP and also to assess its nutritional quality. The results obtained are discussed in to these four categories.

Product Development

Recipe Optimization

When Maida was replaced with APP in the CB formula, quantity of yeast and acetic acid was increased from 1.5 to 2.0% and 0.04 to 0.06%, respectively in order to speed up the proofing. For the same purpose proofing temperature was increased from 37^{0}C to 45^{0}C. As a result proofing time was decreased by 5 minutes. The baking was carried out at 225^{0}C for 15 minutes instead of 205^{0}C for 20 minutes. As suggested by the panelists sugar level was increased to 10% to neutralize the sour taste. The final formula and process flow chart adopted for bread processing is described in Table 1 and Figure 2, respectively.

Sensory Evaluation

During preliminary trials, breads were prepared by replacing 1, 3, 5 and 7% APP. Among that 5 and 7% APP replaced breads resulted in to pour volume and texture when judged using nine point hedonic scales. Therefore, it was decided to prepare bread with 1 to 4% (with 1% interval) APP replacement level for primary selection for further refinement. Among that bread prepared using 2% replacement of APP scored the highest. Therefore, it was decided to prepare bread with 1, 1.5, 2 and 2.5% APP replacement for final selection.

It can be seen from Table 2 that all the characteristics of the APP replaced breads scored more than acceptable with no significance difference but were significantly differ with CB. It was also observed that almost all the characteristics were increased upon increasing the APP replacement level in bread preparation up to 2% and there after that were decreased. However, breads prepared up to 1% supplementation of amala powders, prepared using different drying techniques, found acceptable.[3] While[8] reported that breads incorporated with amala powder up to 5% did not affect the sensory qualities. That may be due to varietal difference.

Consumer Survey

Most of the faculty members (77.88%) found the EB acceptable i.e. liked excellent, very good and good and was found at par with the CB in all the likings. About half and one fourth consumers rated the EB good and very good, respectively. The detail liking of CB and EB are represented as Chart 1.

Nutritional Composition

The protein content of APP found about one fourth as compared to Maida. All the proximate composition for Maida found more or less similar to reported by Baljeet[2]. The ash (2.75%) and protein (3.17%) content of APP found almost equivalent (1.99 to 2.36%) and (2.96 to 3.26%), respectively to reported by Dina[3] for amala powder prepared using different techniques. However, the fiber content (17.87%) was almost double (8.23 to 9.98%) while fat content (0.45%) was one fifth (2.36 to 2.96%). These may be due varietal difference. The fiber and ash content of EB was increased by 11.43% and 1.56%, respectively as compared to CB. The ash (1.17%) and carbohydrate (83.14%) content found slightly higher as compared to reported by Rajeswari[8] (i.e. 72.13% and 0.66%, respectively on 5% addition of amala powder) while protein content was found decreased (11.24%) then Rajeswari[8] (14.75%). Nutritional compositions of principle raw ingredients as well as commercial and developed breads are depicted in Table 3.

Conclusion

Acceptable quality bread by replacing maximum 2% Maida with APP could be prepared by the optimized formula and procedure. It contains 11.43% more fiber and 1.56% more minerals as compared to CB. Thus it may be useful in the dietary management of patient suffering from chronic diseases to replace the normal bread.

Future Scope

Like bread other bakery products such as biscuits, cookies, cakes and pastries could be modified to make it useful for life style diseases.

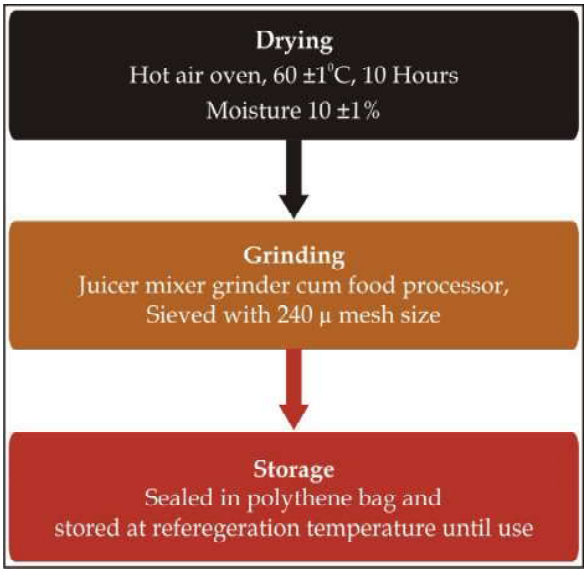

Fig. 1: Process Flow Chart of Amala pomace drying.

Table 1: Formula for control and amala pomace powder replaced breads.

Product/ Ingredients	Quantity (baker's percentage)	
	Control Bread	APP Replaced Bread
	(A)	(C)
Flour	**100**	**98.0**
APP	**Nil**	**2.0**
Oil	2.0	2.0
Sugar (powdered)	**5.0**	**10.0**
Yeast (Dry)	**1.5**	**2.00**
Gluten	1.0	1.0
Salt	2.0	2.0
Water	64	68
Acetic acid	**0.04**	**0.06**

Processing conditions	Temperature	Time (Minute) / Use of
Weighing	RT	15
↓		
Kneading	RT	20, Spiral mixer
↓		
Scaling	RT	Cutter
↓		
Rounding	RT	Hand
↓		
Intermediate proofing	37^{0}C	10, Proover
↓		
Moulding and Panning	RT	5
↓		
Proofing	37^{0}C (C)	60, Proover
↓	45^{0}C (E)	55, Proover
Baking	205^{0}C	(C)20, Oven
↓	225^{0}C	(E)15, Oven
Cooling	RT	60, Cooling rack
↓		
Slicing and Packing	RT	5, Slicer

C = Control, E = Experimental

Fig. 2: Process flow chart for control and APP replaced bread.

Fig. 2a: Experimental bread

Table 2: Sensory score of control and amala pomace powder replaced bread.

Charact-eristic/ Produ	Volume 15	Crust chara-cter$ (5)	Shape and bake@ (10)	Crumb colour (10)	Texture and Grain (30)	Taste and aroma (20)	Overall accep-tability (10)
Control	13.17^a ± 0.23	4.42^a ± 0.06	8.47^a ± 0.18	9.11^a ± 0.16	26.50^a ± 0.75	18.17^a ± 0.27	8.89^a ± 0.13
1% APP	10.83^b ± 0.74	3.49^b ± 0.22	7.08^b ± 0.48	6.97^c ± 0.46	21.75^b ± 1.48	14.72^b ± 0.95	7.22^c ± 0.47
1.5% APP	11.00^b ± 0.24	3.60^b ± 0.10	7.44^b ± 0.22	7.17^{b,c} ± 0.22	20.67^b ± 0.52	14.72^b ± 0.39	7.08^c ± 0.12
2% APP	11.75^b ± 0.22	3.74^b ± 0.08	7.65^b ± 0.26	6.83^b ± 0.12	20.83^a ± 0.56	16.06^b ± 0.24	8.00^b ± 0.09
2.5% APP	10.67^b ± 0.25	3.44^b ± 0.10	7.28^b ± 0.19	6.78^c ± 0.21	21.33^b ± 0.80	14.50^b ± 0.38	6.97^c ± 0.16
'F' Value	6.85**	10.22**	3.55*	12.95**	8.01**	9.05**	11.29**
CV%	14.55	14.09	15.98	14.76	16.41	13.93	13.39

APP = Amala Pomace Powder

Control = 100% Maida (Baker's %)

$ Crust character = Colour and nature of the crust

@ Shape and bake = Symmetry of shape and uniformity of bake.

All the replacements are based on baker's percentage.

Values are Mean ± SEM scores of a composite scoring test by a panel of 6 judges X 3 replications

Means bearing the same superscript within the column do not differ significantly (p = 0.05) ** p = 0 . 0 1 (by DNMR test).

Values in parentheses indicate number of maximum score.

N = 113

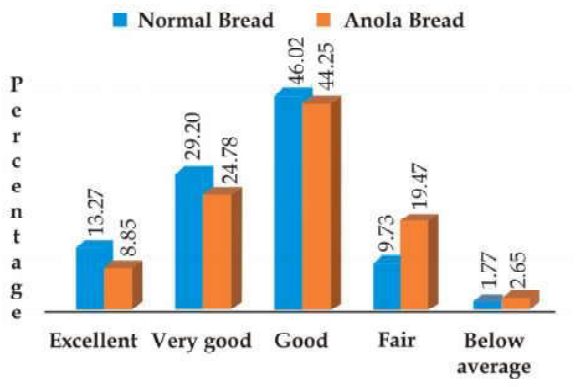

Chart 1: Consumer liking for control and experimental bread.

Table 3: Nutritional composition of control and experimental bread.

Nutrient	Maida	APP	Control Bread	Experimental Bread	% Change
Moister (g%)	13.12 ± 0.12	9.87 ± 0.22	36.36 ± 0.25	36.33 ± 0.36	-0.08 ± 0.00
Protein (g%)	11.28 ± 0.15	3.17 ± 0.01	11.37 ± 0.11	11.24 ± 0.19	-1.14 ± 0.01
Fat (g%)	1.57 ± 0.01	0.45 ± 0.00	3.81 ± 0.02	3.80 ± 0.02	-0.26 ± 0.00
Carbohydrate (g%)	85.39 ± 1.10	75.76 ± 1.12	83.13 ± 0.63	83.14 ± 1.16	0.01 ± 0.00
Calorie (K. Cal.)	400.82 ± 10.10	319.77 ± 8.18	494.96 ± 9.35	476.18 ± 24.00	-3.79 ± 0.00
Fiber (g%)	1.08 ± 0.10	17.87 ± 0.32	1.05 ± 0.01	1.17 ± 0.00	11.43 ± 0.15
Ash (g%)	0.68 ± 0.01	2.75 ± 0.02	0.64 ± 0.05	0.65 ± 0.01	1.56 ± 0.01

Control bread (0% APP)

Experimental bread (2% APP)

Values are Mean ±SEM of 3 replications

All the data except moisture is reported on dry weight bases.

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