Original Article

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Optimization of High Fiber Bun Formula and its Nutritional Evaluation

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Abstract

Dietary fibers play a multifaceted role in preventing a number of health disorders Bakery products now become essential food items of a vast majority of the population in India. These are bearing negligible fiber. *"Tur"* husk - bran is byproduct of milling industry and used mainly for cattle feed hence possesses low economical value. This study is therefore planned with a view to develop standardized process for high fiber bun using Pigeon pea husk. For that, Refined Wheat Flour was replaced with 2, 4, 6, 8 and 10% of PPH in the commercial bun formula and product optimization was carried out using sensory evaluation. Raw material, control and experimental buns were analysed for various nutrients using standard methods. Coast is also calculated for economical evaluation for industrial viability. Data analysed statistically. An acceptable quality high fiber bun by replacing maximum 8% RWF with PPH could be prepared by the final formula and procedure standardized. It contains more fiber and less energy as compared to control biscuit. It found economically viable and thus could easily marketed among Indian consumer chiefly consist of middle class population.

Keyword: Health Food; Bakery Products; Pigeon Pea Husk; High Fiber Food.

Introduction

Increasing health consciousness increased demand for "health food", including bakery products (Rao, 1993). Dietary fibers play a multifaceted role in preventing a number of health disorders (i.e. hypercholesteremia, diabetes and cancer), increases bulk of fecal mass, reducing the transit time of fecal mass in the small intestine (Potty, 1996). In India, bakery products now become essential food items of a vast majority of the population (Kamaliya, 2005). But still per capita consumption of bakery products at present is very low as compared to developed countries. There is a need for diversification of baked products for further growth. One of the ways of achieving it is by producing various healthy and therapeutic bakery products (Rao, 1993). Normally bakery products are prepared with refined wheat flour (*maida*), hydrogenated fat (*vanspati*) / shortening and sugar as the principle ingredients. These are calorie dense, bearing negligible fiber and contain a low quantity and quality of protein. *"Tur"* husk - bran is byproduct of milling industry and used mainly for cattle feed hence possesses low economical value. Bakers have limited funds and facilities to develop bakery products. This study is therefore planned with a view to develop standardized process for high fiber bun using Pigeon pea husk (PPH) having low cost technology.

Objectives

1. To investigate the possibility of developing high fiber bun using pulse bran, in particular PPH.
2. To standardize the process parameters of high fiber bun based on sensory properties.
3. To evaluate the nutritional quality of the developed bun.

Methodology

Good quality raw materials were purchased from the local market of Anand except PPH, which was supplied by "Laxmi Proteins Ltd., Vasad". PPH was

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soaked overnight in water, followed by pressure cooking for 10 minutes, then it was allowed to dry overnight, ground and sieved with 240m mesh size and used for bun preparation. Soaking, cooking, fermentation reduces the oligosaccharides, which are responsible for causing flatulence in the pulses (Khattab and Arntfield, 2009). Bun was prepared as per the commercial formula suggested by Kamaliya and Kamaliya (2001).

Refined Wheat Flour (RWF) was replaced with 2, 4, 6, 8 and 10% of PPH in the commercial bun formula. Repeated trials with changes in quantity of raw materials (yeast, water and acetic acid) as well as processing conditions (time and temperature for fermentation, final proofing and baking) were carried out to standardize the recipe. The bun prepared using the adopted formulas were sliced, randomized and presented to the panelists for evaluation of sensory characteristics. The buns were evaluated first for initial acceptability using a 9 point hedonic scale (Larmond 1977) (6 members X 3 replications) on the day of preparation (i.e. day 0). 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 ranks of hedonic rating were converted to scores and analysed statistically. The bun that scored atleast up to 5 points with maximum incorporation of the PPH was selected for final study. Replacement rate of newly introduced raw ingredients were narrowed down in such a way that percent replacement of PPH of "selected product" remains some were in the middle.

On the bases of these results, RWF was replaced with 4, 5, 6, 7 and 8% PPH for the final selection. That was carried out again by sensory evaluation using a composite scoring test on the day of preparation. The proforma used was prepared on the basis of the composite scoring test of Pyler (1988). A sensory judging panel was constituted with six panelists from among the faculties and Students of the Faculty of food processing technology as well as dairy science. The panelists evaluated volume, colour and nature of crust, uniformity of bake and shape, texture and grain, crumb colour, taste and aroma and overall acceptability. Bun prepared using the commercial formula (i.e. 0% PPH) served as the control bun (CB) and was used for comparison.

Refined wheat flour, PPH and control and experimental buns were analysed for various nutrients namely moisture, protein (macro-Kjeldahl method), fat (soxhlet method), carbohydrate (anthrone method), energy (calculated), fiber and ash using standard methods.

The coast is also calculated for normal as well as experimental bun and compared for economical evaluation for industrial viability as per the procedure followed at the School of Baking, Anand Agricultural University, Anand.

The standard SPSS program was run to analyse the data. All the data were tested for significance using the ANOVA / Duncan's test (Steel and Torrie, 1980).

Results and Discussions

As mentioned earlier the present study was planned to develop value added bun and also to assess the food properties and nutritional quality. The results obtained are discussed in to four categories.

Recipe Optimization

When RWF was replaced with PPH in the CB formula, quantity of yeast and acetic acid was increased from 1.5 to 1.75 % and 0.04 to 0.05 %, respectively in order to speedup the fermentation. For the same purpose fermentation and proofing temperature was increased from 26.6^{0}C to 37^{0}C and from 37^{0}C to 50^{0}C, respectively. As a result fermentation and proofing time was decreased by 45 minutes. The baking was carried out at 220^{0}C for 15 minutes instead of 205^{0}C for 20 minutes.

Sensory Evaluation

The bun prepared by replacing 6 % PPH scored "Neither like nor Dislike" when judged using nine point hedonic scale during primary screening. Therefore, it was decided to prepare bun with 4, 5, 6, 7 and 8 % PPH replacement level for final selection.

Composite scoring test was conducted for the selection of supplementation level of PPH. The results obtained are depicted in Table 1. Control bun containing no PPH scored the highest for all the sensory attributes studied. In contrast to this buns prepared using maximum (i.e. 8%) replacement of RWF with PPH scored the least in all the sensory characteristics. A decreasing trend in all the sensory attributes was observed upon increasing the levels of PPH supplementation.

Volume of the control and up to 6% PPH replacement do not differ significantly however rest both the replacements were differ significantly but

scored more than acceptable. Similar the case with the symmetry of shape and uniformity of bake characteristic. The colour and nature of the crust character and of the control bun differ significantly to the experimental buns but were found acceptable by the panel of judges. Texture and grain as well as taste and aroma characteristics of bun prepared with 8% PPH replacement were significantly different than other buns including control. However, in case of control bread both the characteristics were significantly differ than experimental bun.

The bun prepared up to 6% replacement of PPH found satisfactory during first year and upto maximum (8%) during next two years in all the sensory characteristics with an overall quality. The soaking and steaming treatment given to PPH may increase acceptability alongwith decrease in flatulence. Thus bun with 8% PPH replacement was considered as Experimental Biscuit (EB) for further experimentation.

However judges commented that, replacement of PPH at 4 and 5% level improved the taste and aroma. During second year of experiment some judges commented that, some grittiness was found at the end of chewing or when chewing was about to complete. Therefore, the ground PPH was sieved with 240 m mesh size and no such comment was found during third year experimentation.

Nutritional Composition

The protein content of PPH found about 75% less as compared to RWF because of very high content of fiber. The fiber content of 8% PPH replaced bun was found twentytwo times higher as compared to CB due to addition of PPH containing 85.89% total fiber. The carbohydrate and energy value were reduced in EB as compared to CB. Both the situations have

Table 1: Sensory (composite) scores of buns prepared by replacing refined wheat flour with different levels of pigeon pea husk

Characteristic Product	Volume (15)	Crust character$ (5)	Shape and bake@ (10)	Crumb colour (10)	Texture and Grain (30)	Taste and aroma (20)	Overall acceptability (10)
Control #	11.86^{a}	4.12^{a}	7.83^{a}	8.37^{a}	23.67^{a}	16.30^{a}	8.20^{a}
	± 0.17	± 0.07	± 0.14	± 0.12	± 0.42	± 0.23	± 0.10
4 % PPH	11.07^{ab}	3.40^{b}	7.20^{ab}	6.93^{b}	21.22^{b}	14.59^{b}	7.16^{b}
	± 0.19	± 0.08	± 0.15	± 0.16	± 0.48	± 0.29	± 0.12
5 % PPH	10.67^{abc}	3.32^{bc}	6.94^{ab}	6.64^{bc}	20.28^{bc}	13.72^{bc}	6.94^{b}
	± 0.20	± 0.08	± 0.14	± 0.17	± 0.50	± 0.27	± 0.12
6 % PPH	10.31^{abc}	3.14^{bc}	6.74^{ab}	6.41^{bc}	20.00^{bcd}	12.87^{bcd}	6.56^{b}
	± 0.21	± 0.08	± 0.16	± 0.13	± 0.50	± 0.28	± 0.13
7 % PPH	9.44^{bc}	2.97^{bc}	6.14^{b}	5.80^{bc}	17.96^{cd}	11.84^{cd}	5.85^{c}
	± 0.32	± 0.09	± 0.19	± 0.18	± 0.56	± 0.31	± 0.15
8 % PPH	8.81^{c}	2.71^{c}	5.73^{c}	5.55^{c}	17.33^{d}	11.33^{d}	5.46^{c}
	± 0.36	± 0.10	± 0.21	± 0.21	± 0.53	± 0.37	± 0.18
F Value	19.39**	34.63**	20.47**	37.24**	21.02**	38.62**	50.01**

PPH = Pigeon Pea Husk
# Control = 100% Refined wheat flour (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 Pooled Mean ± SEM scores for three years 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 d" 0.05), ** p d" 0.01
Values in parentheses indicate number of maximum score

Table 2: Nutritional composition of major raw ingredients, control and sensorily selected experimental bun

Characteristics Product	Moisture (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Energy (K.Cal)	Total fiber (%)	Ash (%)
RWF	10.60	12.24	1.63	85.01	404.00	0.34	0.78
	± 0.03	± 0.10	± 0.02	± 0.58	± 2.38	± 0.03	± 0.02
PPH	6.79	4.11	1.66	5.74	54.34	85.89	2.60
	± 0.13	± 0.10	± 0.03	± 0.15	± 2.54	± 0.32	± 0.12
Control	41.20	11.16	3.54	82.65	407.10	0.31	0.71
	± 0.72	± 0.33	± 0.35	± 1.11	± 2.88	± 0.06	± 0.03
8 % PPH	41.08	11.35	3.63	77.09	368.51	7.03	0.91
	± 0.94	± 0.20	± 0.07	± 0.50	± 1.62	± 0.04	± 0.01

RWF = Refined wheat flour
PPH = Pigeon pea husk
Control = 100% refined wheat flour (bakers %)
All replacements are based on baker's percentage
Except moisture content all parameters are expressed on dry weight basis
Values are mean ± SEM scores of three replications

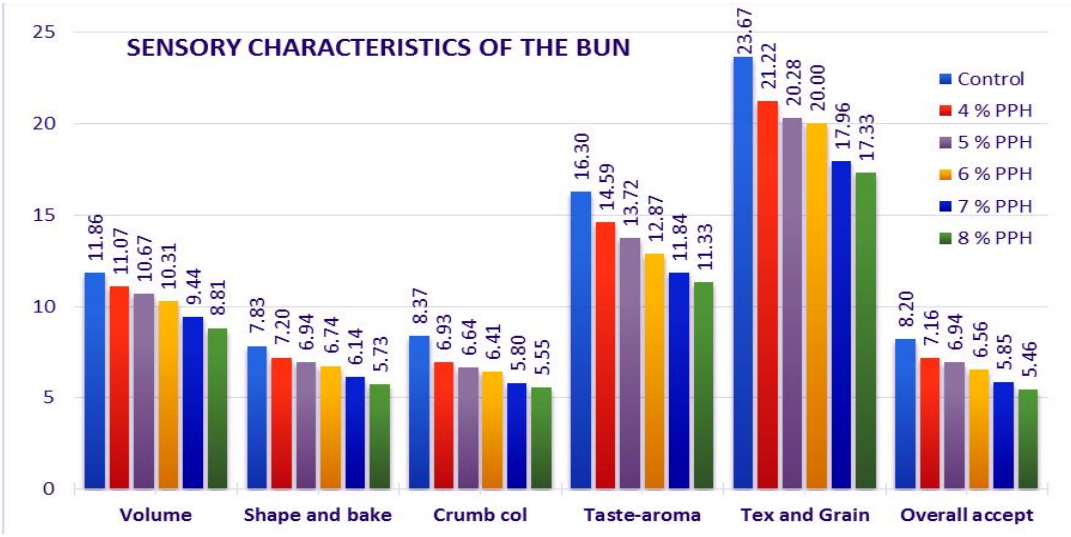

Fig. 1:

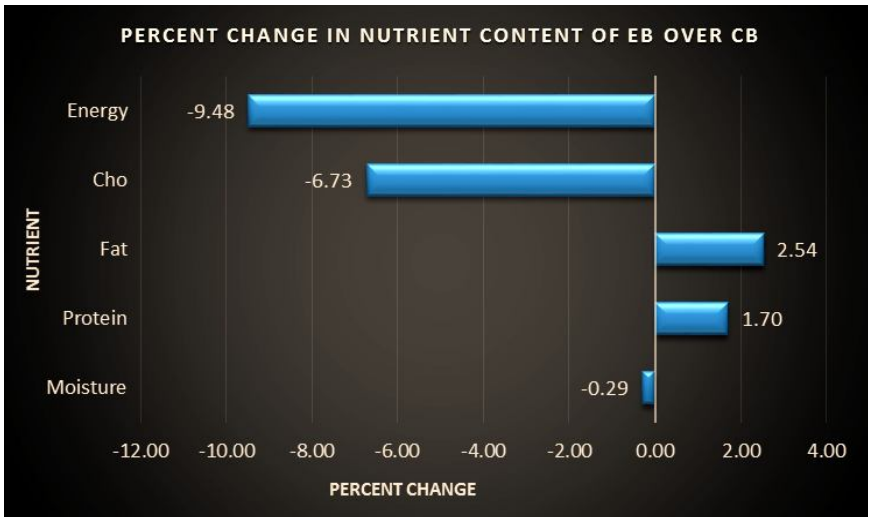

Fig. 2:

beneficial effect on chronic diseases. The protein and fat content was found more or less similar for both the types of buns. Nutritional composition of principle raw ingredients and commercial and developed buns are given in Table–2.

Economical Evaluation

Cost price of EB was slightly reduced as compared to CB because of the lower price of PPH as it is considered as a byproduct of the *"tur-dal"* milling industry.

Conclusion

An acceptable quality high fiber bun by replacing maximum 8% RWF with PPH could be prepared by the final formula and procedure mentioned earlier. It contains more fiber and less energy as compared to CB. Thus it may be useful in the dietary management of patient suffering from diabetes, hypercholestremia, constipation etc. chronic diseases. It found economically viable and thus could easily marketed among Indian consumer chiefly consist of middle class population.

Future Scope

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

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