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FORTIFICATION OF BUCK WHEAT FOR IMPROVEMENT IN SAFETY AND QUALITY OF "KULCHA": A TRADITIONAL KASHMIRI BAKED PRODUCT

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ABSTRACT

Composite flour was prepared by adding 5,10,15,20 % buck wheat flour to fancy clear wheat flour for developing Kulcha. The processed product was stored for 50 days to ascertain the changes in safety and quality. Incorporation of 20% buckwheat flour provided best nutritional quality by depicting highest protein (9.41%), fat (23.97%), fiber (6.75%) and lowest moisture (2.42%).The diameter of kulcha gradually decreased (73.90 to 73.15 mm) and thickness increased (11.38 to 11.44 mm) thereby decreasing the spread ratio (6.493 to 6.394). The safety stability significantly increased with increasing buck wheat levels. At 50 days of storage 20% fortification of buckwheat showed lowest fungal count of 3.301 logcfu/g as compared to 3.668 logcfu/g wherein no buckwheat was added. AWRC and FFA also showed highest values of 55.50% and 0.050% in product prepared with 20% buckwheat flour. In contrary to it the maximum incremental cost benefit ratio was 1.50 in flour combination (wheat: buckwheat flour %; 95:5).

INTRODUCTION

In particular Jammu and Kashmir the traditional bakery industry continues to be very popular. The principal items of production in J&K are chuchwuru, girdha, kulcha and bakerkhani. These are produced in cylindrical ovens popularly known as "tandoors" and others in manually operated bakeries. Its estimated that the current consumption of all bakery products in Jammu and Kashmir alone is about 60 tonnes per day of which over four-fifth takes place in the form of traditional bakery items and most of the bakery items used in the state are native to it and are not used anywhere else in the country or even rest of the world (NPCS, 2012).

Kashmir, truly described as the land of traditional cuisines out of which the major product of this ingenuity is Kulcha, which over time has evolved and established as an important traditional bakery product. Kulcha is a type of cracker made from maida (wheat flour) with nuts and poppy seed topping. It is particularly popular in Jammu and Kashmir, India and Lahore, Pakistan, and is usually eaten with kehwa (the traditional Kashmiri green tea). Monitoring food quality and safety from raw materials to finished products is of great importance to the food industry (Pratima and Yadav, 2000). Osibona*et al*. (2009) reported that losses due to the mould spoilage in bakery industry average about 200 million pounds of products each year. Nagi *et al*. (2012) studied the microbial quality of biscuits prepared with cereal bran incorporation during storage. They reported that the total plate count on nutrient agar media was found nil for fresh biscuits whereas, storage period had a significant effect on microbial quality of biscuits. The count increased from (1.98x102 cfu/g to 62.92x102 cfu/g) after 3 months of storage. However for increasing the nutritional quality of the product, Jozinovic *et al*. (2012) studied the influence of buck wheat and chestnut flour addition on properties of corn extrudates. Flour combination (corn:buckwheat; 30:70) recommended highest protein (10.03%), crude fat (0.42%), crude fiber (0.50%) and ash (1.24%).

Keeping this in view there is a need of increasing the nutritional content and storage stability of this traditional product without affecting its ingenuity. For that wheat flour was fortified with Buckwheat (*Fagropyrum esculentum)* as it is gluten-free in nature, has beneficial nutraceutical properties and shows better safety and stability during storage (Hooda and Jood, 2005). Hence the objectives of the research are to access effect of different flour combinations on the physico-chemical, microbialquality of the product. However its incremental cost benefit ratio was also workedout.

MATERIALS AND METHODS

Raw Material

Wheat (Shalimar wheat-1) was procured from the division of Plant Breeding and Genetics, SKUAST, Kashmir. Buck wheat

was purchased from the Global Trading Ltd., Jagadhari, Haryana, India. The wheat flour used for product formulation was fancy clear flour (55% extraction rate), while as, buck wheat flour used was straight run flour (100% extraction rate). The milling was done in Buhler Pneumatic Mill.

Preparation of Traditional Kulcha

The process for preparation of Kulcha using flour of wheat was standardized using creaming method (Singh *et al.*, 2005). Kulcha was prepared from wheat and buck wheat flour in the ratios of 100:0, 95: 5, 90:10, 85:15, 80:20 %. In this method, all the fat and sugar was creamed together adding sugar gradually. Then flour was added in the mixture. Flour was sifted with baking powder. The flour was mixed with batter in mixer at a slow speed in order to achieve appropriate texture of batter. Then the eggs which were whipped prior were added followed by addition of milk, milk powder and salt. The batter was then sheeted and the poppy seeds were sprinkled on it. The sheet of batter was then cut into shape with the help of cutter, and baked at 150 °C for 35 minutes followed by cooling at ambient temperature and packing.

Proximate analysis of wheat-buck wheat Kulcha

Thickness and diameter of Kulcha was measured by using Vernier calliper. Spread ratio was calculated by dividing diameter with thickness whereas weight loss before and after baking was calculated by using weighing balance (AACC, 1990). Moisture and crude fibre were determined according to AOAC (1995). Crude protein was estimated by using micro-kjeldahl method, AOAC (1995) using the factor 6.25 for converting nitrogen content into crude protein. For fat content of noodles, 5 g sample was placed in Soxhlet extraction apparatus and subjected to extraction for 6 h using petroleum ether as solvent and percent fat content of biscuit samples were calculated on a weight basis. Sugarswere determined by potassium ferricyanide method where 5.675 g flour of each treatment was extracted with sodium acetate buffer (50 ml) followed by immediate addition of sodium tungstate solution (2 ml, 12 %) and results were expressed as per cent glucose (AACC, 1990). Free fatty acid was determined by method given by Singh *et al*. (2000). Ground samples (5 g) taken in stoppard flask benzene (50 ml) was added and kept for 30 minutes with frequent shakings. After filtration, measured aliquot (10 ml) of supernatant liquid was added with equal amount of alcohol (95%) and few drops of indicator and titrated against 0.02 N KOH till permanent pale colour persisted. Results were expressed as per cent oleic acid. The samples were tested for their Alkaline Water Retention Capacaity (AWRC) according to the procedure outlined by AACC (2000). One gram sample was suspended in 5 ml of 0.1 N $NaHCO_3$hydrated for 20 min and centrifuged at 1000 g for 15 min at room temperature. The precipitate obtained was weighed and AWRC was calculated. Fungal count was determined during a storage period of 50 days with an interval of 10 days by the method of serial dilution technique using Potato Dextrose Agar media. The incubation period was 48 hours at 25 ± 2°C. The colonies so formed were expressed in log cfu/gm (Karuna and Kolte, 2005).

Statistical analysis

The data obtained (in triplicate) were evaluated statistically with OPSTAT package program by variance analysis. When variance analysis showed significant difference ($p < 0.05$) among the means, the least difference test was used to evaluate means.

RESULTS AND DISCUSSION

Physico-chemical composition of wheat and buck wheat flour

Table 1 depicted the physico-chemical parameters of wheat and buck wheat flour. Highest protein (11.97%), fat (1.95%), ash (1.80%), fiber (2.36%), dough development (2.50 min) were recorded in buck wheat flour. However wheat flour depicted highest moisture of 12.36%, water absorption of 58.25%, peak viscosity of 3390 cp and wet gluten of 25.42%.

Physical Evaluation of traditional Kulcha

Table 2 reveals the effect of flour combination on physical parameters of Kulcha. The highest diameter of 73.90 mm was observed in flour combination (wheat: buckwheat flour: 100:0)and the lowest diameter of 73.15 mm was recorded in flour combination (wheat: buckwheat flour: 80:20). This is because the cookie diameter dramatically decreases with

Table 1: Physico-chemical composition of wheat and buck wheat flour

Parameter	Flour	
	Wheat (55% Extraction Rate)	Buck Wheat (100% Extraction Rate)
Moisture (%)	12.36	11.12
Protein (%)	8.07	11.97
Fat (%)	1.84	1.95
Ash (%)	1.31	1.80
Fiber (%)	0.72	2.36
Water absorption (%)	58.25	30.4
Peak viscosity (cp)	3390	1080
Dough development time (min)	1.62	2.50
Wet Gluten (%)	25.42	GLUTEN FREE

Table 2: Effect of flour combinations on physical parameters of Kulcha

Flour combinations (Wheat: Buckwheat flour%)	Diameter (mm)		Thickness (mm)		Spread ratio		Weight loss (g)	
	Before Baking	After Baking	Before Baking	After Baking	Before Baking	After Baking	Before Baking	After Baking
100:0	70.00	73.90	10.00	11.38	7.000	6.493	100.00	96.63
95:5	70.00	73.75	10.00	11.39	7.000	6.474	100.00	96.71
90:10	70.00	73.51	10.00	11.42	7.000	6.436	100.00	96.78
85:15	70.00	73.34	10.00	11.42	7.000	6.422	100.00	96.82
80:20	70.00	73.15	10.00	11.44	7.000	6.394	100.00	96.89
Mean	70.00	73.53	10.00	11.41	7.000	6.444	100.00	96.76

Table 3: Effect of flour combinations on nutritional composition of Kulcha

Flour combinations(Wheat: Buckwheat flour %)	Moisture	Crude Fiber	Crude Protein	Crude Fat	Total Sugar
100:0	3.59	5.87	8.01	22.28	13.15
95:5	3.28	6.02	8.34	22.73	12.86
90:10	2.96	6.31	8.69	23.16	12.60
85:15	2.76	6.51	9.01	23.56	12.30
80:20	2.42	6.75	9.41	23.97	12.04
Mean	3.00	6.29	8.69	23.14	12.59

CD ($p \leq 0.05$) FlourCombinations : 0.008

Table 4: Effect of flour combinations and storage periods on fungal count log (cfu/g) of Kulcha.

Storage days	Flour combinations (Wheat: Buckwheat flour %)					Mean
	100:0	95:5	90:10	85:15	80:20	
0	0.000	0.000	0.000	0.000	0.000	0.000
10	2.523	0.000	0.000	0.000	0.000	0.505
20	2.823	2.523	0.000	0.000	0.000	1.069
30	3.000	2.828	2.523	0.000	0.000	1.670
40	3.522	3.425	3.301	3.000	2.828	3.215
50	3.668	3.602	3.522	3.425	3.301	3.504
Mean	2.589	2.063	1.558	1.071	1.022	1.661

CD($p \leq 0.05$) Flour Combination (F) :0.0001; Storage (S):0.0001; F x S :0.0010

Table 5: Effect of flour combinations on alkaline water retention capacity (%) of Kulcha

Flour combinations (Wheat: Buckwheat flour%)	Alkaline water retention capacity (%)
100:0	46.95
95:5	49.47
90:10	50.69
85:15	53.09
80:20	55.50
Mean	51.14

CD($p \leq 0.05$) FlourCombination (FC):0.007

higher level of damaged starch in both wheat and buck wheat flour (Baljeet *et al*. (2010)). However the maximum and the minimum thickness of 11.44 mm and 11.38 mm was observed in flour combination (wheat: buckwheat flour: 80:20) and (wheat: buckwheat flour: 100:0). The spread ratio varied from 6.493 [flour combination (wheat: buckwheat flour: 100:0)] to 6.394 [flour combination (wheat: buckwheat flour: 80:20)]. The highest weight loss (96.89 g) was observed in flour combination (wheat: buckwheat flour: 80:20) and the lowest weight loss 96.63 g was recorded in flour combination (wheat: buckwheat flour: 100:0). Similar results were reported by Varshney *et al*. (2008), Masur *et al*. (2009), Mohamed *et al*. (2009) and Poongodi and Jemima (2010).

Nutritional Evaluation of low gluten Kulcha

The proximate composition of the Kulcha produced in presented in Table 3. Significant differences (pd"0.05) existed among all the samples including the control 100%wheat. The highest moisture content of 3.59% was observed in Kulcha (wheat: buckwheat flour; 100:0) than 2.42% in buck wheat supplemented Kulcha (wheat: buckwheat flour; 80:20) may be because of the greater water binding properties of wheat flour than buck wheat flour (Mancebo *et al.,* 2015). The crude fiber content of 6.75% in buck wheat Kulcha(wheat: buckwheat flour; 80:20) is higher than 5.87% in wheat Kulcha (wheat: buckwheat flour; 100:0). This is because of lower amount of fiber in fancy clear wheat flour (Nicoletta and Carlo, 2015). The protein content increased with increased substitution of buckwheat flour as buck wheat has abundant protein content and is called as a complete protein food (Ozola *et al*. 2011). The protein content ranged from 8.01% in flour combination (wheat: buckwheat flour; 100:0) to 9.41% in flour combination (wheat: buckwheat flour; 80:20). The fat content of 22.28% was observed in Kulcha (wheat: buckwheat flour; 100:0) and 23.97% in Kulcha (wheat: buckwheat flour; 80:20). The total sugar of 12.04% in Kulcha (wheat: buckwheat flour; 80:20) was lower than 13.15% in Kulcha (wheat: buckwheat flour; 100:0) because of lower amount of free sugar content as compared to the wheat flour (Jozinovic *et al*. (2012)).

Microbial quality of Kulcha

Fungal loss is the leading cause of economic loss in bakery industry. Although the fungal spores are killed in dough during baking, air borne mould typically contaminate the end product during cooling, wrapping and ultimately storage (Samapundo *et al*. (2010)). The contamination occurs from air, bakery surfaces, equipments, food handlers after baking (Omer *et al*. (2010)). Data pertaining on fungal count (log cfu/g) of kulcha depicted that flour combination had a significant influence over fungal growth . It was reported that no fungal growth was observed in ambient conditions (28 ± 2^{o}C) at 0 days of storage irrespective of treatment combinations. Similarly no fungal growth was observed in kulcha prepared using flour combinations (wheat: buckwheat flour; 95:5 , wheat: buckwheat flour; 90:10,wheat: buckwheat flour; 85:15,wheat: buckwheat flour; 80:20) at 10 days of storage, the flour combinations (wheat: buckwheat flour; 90:10,wheat: buckwheat flour; 85:15,wheat: buckwheat flour; 80:20) at 20 days of storage and flour combinations (wheat: buckwheat flour; 85:15,wheat: buckwheat flour; 80:20) at 30 days of storage. Maximum fungal count of 3.668 log cfu/g was

Table 6: Effect of flour combinations and storage periods on free fatty acids (%) of Kulcha.

Storage days	Flour combinations(Wheat: Buckwheat flour %)					Mean
	100:0	95:5	90:10	85:15	80:20	
0	0.000	0.000	0.000	0.000	0.000	0.000
10	0.028	0.031	0.032	0.033	0.036	0.032
20	0.031	0.035	0.036	0.037	0.039	0.036
30	0.034	0.038	0.039	0.041	0.042	0.039
40	0.037	0.041	0.042	0.044	0.047	0.042
50	0.041	0.044	0.046	0.047	0.050	0.046
Mean	0.029	0.032	0.033	0.034	0.036	0.032

CD($p \leq 0.05$) FlourCombination (FC):0.001 ; Storage (S) :0.001;FCxS:0.001

Table 7: Effect of flour combinations on relative economics studies of Kulcha

Flour combinations (Wheat: Buckwheat flour%)	FC (Rs)	VC (Rs)	TC (Rs)	Quantity (kg)	Rate (Rs)/ 500gm	Returns (Rs)/(2kg)	ICBR
100:0	49	145	194	2	120	240	1.23
95:5	49	150	199	2	150	300	1.50
90:10	49	155	204	2	150	300	1.47
85:15	49	160	209	2	150	300	1.43
80:20	49	165	214	2	150	300	1.40

FC: Fixed cost VC: Variable cost Total cost: Total cost ICBR: Incremental cost benefit ratio

recorded in wheat Kulcha (wheat: buckwheat flour; 100:0)(Table 4). Similar results have been observed by Ajay *et al*. (2014), Manoj *et al*. (2014) and Tasnim and Suman (2015).

Alkaline water retention capacity (%)

AWRC is a test to correlate the cookie diameter. Good cookies flour hold water poorly. The cookies diameter decreased with the higher level of damaged starch in both wheat and buck wheat flour because damaged starch absorbs more water than does un-damaged starch (Ahmed *et al.,* 2010). The main hydrophilic components of a cookie formula are flour and sugar. Lower water absorbed by flour provokes higher water absorption by sugar that increments syrups and decreases dough viscosity during baking. Consequently dough spreads further producing large diameter cookies (Mohamed *et al*. 2009). The flour fractions consisting of pentosans, proteins, glycoproteins and damaged starch is thought to be responsible for the retention of alkaline water (Gabriela *et al.,* 2007).

Flour combination and storage periods depicted a significant influence on AWRC of Kulcha. Amongst the overall means for flour combination (wheat: buckwheat flour; 80:20) recorded the maximum mean alkaline water retention capacity of 55.50% followed by 53.09% in flour combination (wheat: buckwheat flour; 85:15) while as, wheat Kulcha (wheat: buckwheat flour; 100:0) recorded a minimum alkaline water retention capacity of 46.95%. (Table-5).

Free fatty acid (% Oleic acid)

The free fatty acids were formed due to the oxidation of fats into free fatty acids (Nagi *et al*.2012).The maximum free fatty acid of 0.050 % was observed in flour combination (wheat: buckwheat flour %; 80:20) at 50 days of storage (Table-6). Amongst the overall means for flour combination (wheat: buckwheat flour %; 80:20) recorded the highest mean free fatty acid of 0.036 % while as, flour combination (wheat: buckwheat flour %; 100:0) recorded the lowest of 0.029%. An increase in the free fatty acid was observed from 0.000% (0 day of storage) to 0.046% (50 days of storage).

Incremental cost benefit ratio

Table 7 reveals the overall effect of flour combinations on incremental cost benefit ratio of Kulcha. The data revealed that the maximum incremental cost benefit ratio of 1.50 was observed in flour combination (wheat: buckwheat flour %; 95:5) because of higher market returns in terms of taste and over all acceptability. However minimum incremental cost benefit ratio of 1.23 was recorded in flour combination (wheat: buckwheat flour %; 100:0).

REFERENCES

AACC 1990. *Approved methods of American Association of Cereal Chemistry*. Saint Paul, Minnesotea, U.S.A, pp. 142-153.

AACC 2000. Approved methods of American Association of Cereal Chemistry. *Saint Paul, Minnesotea,* U.S.A.

Ahmed, M. S. H., Mohie, M. K. and Gamal, H. R. 2010. Technological properties of some Egyptian New wheat varieties. *J. American Science*. **6(10):** 1160-1171.

Ajay, T., Ramji, S. and Manoj K. M. 2014. Determination of suitaibility of Deoiled Cakes of Neem, and Jtropha for mass multiplcation of *Pseudomanas flourescans*. *The Bioscan*. **9(3):** 1291-1294.

AOAC 1995. *Official methods of analysis*.14th edition.Association of Official Analytical Chemists, Washington, D. C. pp. 124-130

Baljeet, S. Y., Ritika, B. Y. and Roshan, L. Y. 2010. Studies on functional properties and incorporation of buckwheat flour for biscuit making. *International Food Research J.* **17:** 1067-1076.

Gabriela, N. B., Gabriela, T. P., Pablo, D. R. and Alberto, E. L. 2007. Influence of damaged starch on cookie and bread making quality. *European Food Research Technology*. **225:** 1-7.

Hooda, S. and Jood, S. 2005. Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. *Food Chemistry*.**90:** 427-435.

Jozinovic, A., Subaric, D., Durdica, A., Babic, J., Klaric, I., Kopjar, M. and Kristina, V. L. 2012. Influence of buckwheat and chestnut flour addition on properties of corn extrudates. *Croatian J. Food*

Science and Technology. **4(1):** 26-33.

Karuna, V. and Kolte, S. J. 2005. Essentials of Phytopathological Techniques.Kalyani Publishers, Noida U.P. India. pp 27-29.

Mancebo, C. M., Picon, J. and Gomez, M. 2015. Effect of flour properties on quality characteristics of gluten free sugar snap cookies. *Food Science and Technology*. **52(10):** 6323-33.

Manoj, K. M, Singh, R. and Tomer, A. 2014. Determination of suitabilty of Deoiled and Mahua for mass multiplcation of *Pseudomonas flourescens.The Bioscan*. **9:** 371-374.

Masur, K. C., Shakuntala, B., Tarachand and Kulkurni, U. N. 2009. Development of high protein biscuits from Bengal gram flour. *Karnataka J. Agricultural Sciences*. **22(4):** 862-864.

Mohamed, A. E., Abd-Elmotaleb, N. M. and Baumy, H. A. 2009. Bioavailability of calcium from different sources for balady bread fortification. *Egyptian J. Food Science*. **37(1):** 26-38.

Nagi, H. P. S., Kaul, J., Dar, B. N. and Sharma, S. 2012. Effect of storage period and packaging material on shelf life of cereal bran incorporated biscuits. *American J. Food Technology*. **7(5):** 301-310.

Nicoletta, Pellegrini and Carlo, A. 2015. Nutritional aspecxts of gluten free products. *J. Science Food and Agriculture*. **95(12):** 2380-2385.

NPCS board. 2012. Manufacture of Food & Beverages (2nd Edn.). NIIR Board of Consultants and Engineers. *Kamla Nagar,* New Delhi, India.

Omer, M. T., Salim urRehman., Ghulam, M. D. and Mian, A. M. 2010. Studies on shelf life of bread using acidulants and their salts. *Turkish J. Biology*. **34:** 133-138.

Osibona, A. O., Akinwande, A. T., Ozor, P. and Akande, R. 2009. The nutritional composition, sensory evaluation and microbiological studies of fish cake. *African J. Food Science*. **3(7):** 177-183.

Ozola, L., Straumite, E. and Klava, D. 2011. Extruded Maize flour effect on quality of gluten free bread. In: *Procession of 6th Baltic Conference on Food Science and Technology. Innovations for Food Science and productions*. Latvia, Jelagava. pp. 131-136.

Poongodi, V. and Jemima, B. M. 2010. Characterization of millet flour blend incorporated rusk. *Beverage and Food World*. **24:** 43-46.

Pratima, A. and Yadav, M. C. 2000. Effect of incorporation of liquid dairy by-products on chemical characteristics of soy-fortified biscuits. *J. Food Science and Technology*. **37(2):** 158-161.

Samapundo, S., Deschuyfteleer, N. and Van, L. D. 2010. Effect of NaCl reduction and replacement on the growth of fungi important to the spoilage of bread. *J. Food Microbiology* **27:** 749-756.

Singh, D., Chauhan, G. S., Tyagi, S. M. and Suresh, I. 2000. Extruded snacks from composite of rice brokens and wheat bran. *J. Food Science and Technology*. **37:** 1-5.

Singh, G., Asha, K. and Sehgal, S. 2005. Development and nutritional evaluation of products prepared from dried powder of cauliflower leaves. *Journal of Food Science and Technology*. **42(2):** 137-139.

Tasnim,Farzana and Suman Mohajan. 2015. Effect of incorporation of soy flour on nutritional and sensory quality of biscuits fortification with mushrooms. *Food Science And Nutrition*. **3(5):** 363-369.

Varshney, A. K., Sangani, V. P. and Antala, D. K. 2008. Development of nutritious product from defatted pea nut flour and cereals.*Indian Food Packer*. **22(2):** 60-64.