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Nutritional evaluation of buckwheat genotypes and its utilization in the preparation of supplemented biscuits

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Six buckwheat samples were analyzed for physico-chemical characteristics. Crude protein, crude fat, ash, crude fibre, free fatty acids, free amino acids and trypsin inhibitor activity were assessed using standard methods. Attempts were made to utilize buckwheat grains flour in preparation of biscuits. Biscuits were supplemented with 10, 20, 30 and 40 per cent buckwheat flour. The prepared biscuits were evaluated for nutritional profile and sensory acceptability. Results of the study revealed that nutritionally rich and organoleptically acceptable biscuits can be prepared using buckwheat flour upto 40 per cent level of supplementation. Development of buckwheat fortified products will not only help cultivation and consumption of nutritionally and medicinally rich underutilized crop but will also help to combat the problem of malnutrition in vulnerable sections of society as buckwheat proteins have better amino acid composition with high levels of lysine.

Key Words : Buckwheat, Nutritional, Functional, Organoleptic, Biscuits

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INTRODUCTION

Buckwheat an important pseudocereal crop commonly known as *Kathu, Fafra, Ogale* or *Bharesh* is a herbaceous erect annual plant belonging to family polygonaceae. In Himachal Pradesh it is widely grown in Kinnaur, Lahaul Spiti and Sirmour districts. Buckwheat is a multipurpose crop. It is rich in proteins, carbohydrates, fibre and essential amino acids. The percentage of essential amino acids of buckwheat is higher than cereals and almost equal to legumes. It also forms a rich source of micro nutrients with special reference to magnesium. The tender shoots of buckwheat are used as leafy vegetables. The flowers of common buckwheat produce good quality honey. The seeds are used in a number of culinary preparations and alcoholic drinks.

Apart from its importance as food crop, the leaves are rich in rutin which is used for strengthening weak blood vessels (Singh and Atal, 1977 and Sarin and Atal, 1970).

Buckwheat is also reported to be useful in treatment of capillary fragility, retinitis and rheumatic fever of hemorrhagic conditions and helpful in management of diabetes and also in cardiovascular ailments.

The nutritional awareness amongst the consumers and the government guidelines have warranted the production of nutritious food products (Prathima and Yadav, 2000). Buckwheat has been utilized in preparation

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of biscuits to improve nutritional value and provide potential health benefits to consumer (Marconi and Carcea, 2001). Biscuits are ready to eat, convenient and inexpensive food products, containing digestive and dietary principles of vital importance. Biscuit owing to their long shelf life are considered useful for nutritional enrichment in feeding programmes (Agarwal, 1990). Hence, an attempt was made to utilize buckwheat in preparation of nutritionally rich biscuits.

METHODOLOGY

Six varieties of buckwheat *viz.*, Himpriya, OC-2, IC-341593, Sangla B-1, Sangla B-118 and SWLBM-4 were procured from Mountain Agricultural Research and Extension Centre, Sangla of CSK Himachal Pradesh Agricultural University, Palampur (Plate A). The buckwheat samples were milled and processed to flour fineness. The milled flours obtained from different samples were stored separately in an air tight container for analysis and for product development studies buckwheat flour obtained from mixture of buckwheat samples was used.

(1-Himpriya; 2-OC-2; 3-IC-341593; 4-Sangla B-1; 5-Sangla B-118; 6-SWLBM-4)

Plate A: Physical appearance of buckwheat samples

Physico- chemical evaluation:

The buckwheat samples were evaluated for various physical parameters. The weight was recorded as 1000-kernel weight in grams. The grains buckwheat were poured in certain known volume. Volume from fixed height and mass of sample occupying that volume was determined and ratio calculated as g/ml. The density was calculated by using kerosene oil displacement method (Bhattacharya *et al.*,1972). The shape and colour of the grains was evaluated on the basis of visual perception. Chemical analysis of all the varieties of buckwheat for crude protein, ash, crude fat was done by standard methods (AOAC, 1990). The crude fibre, total carbohydrates and trypsin inhibitor activity were determined by standard methods (NIN, 1983). The sugars and free fatty acids were evaluated as per method of AACC (1990). The free amino acid content was estimated by method given by Lie (1973).

Standardization of recipes for preparation of biscuits:

Supplementation of buckwheat flour for enrichment of biscuit was done. The method used for preparation of biscuits was standardized in the laboratory keeping in consideration the standard method of American Association of Cereal Chemists (AACC, 1990). Biscuits were prepared by using different proportions of refined wheat flour and buckwheat flour obtained from buckwheat mixture. The proportions of ingredients used for standardizing the recipes of biscuits are presented in Table A. Preparation of biscuits was carried out using refined wheat flour and supplementation of buckwheat flour at 10, 20, 30 and 40 per cent. Shortening and

Table A: Proportions of ingredients used in preparation of biscuits

Ingredients (g)	Proportions (%) of buckwheat flour used				
	0	10	20	30	40
Refined wheat flour	45	40.50	36.00	31.50	27.00
Sugar	26	26	26	26	26
Shortening	12.8	12.8	12.8	12.8	12.8
Sodium bi carbonate	0.50	0.50	0.50	0.50	0.50
Salt	0.42	0.42	0.42	0.42	0.42
Glucose solution (ml)	6.60	6.60	6.60	6.60	6.60

creaming techniques were used. The biscuits were baked at 180 °C for 15 min. After cooling for 30 min, the biscuits were packed air tight containers and used for evaluation of various physico-chemical and sensory characteristics.

Physico-chemical and organoleptic evaluation of supplemented biscuits:

Effect of supplementation of buckwheat flour on the protein, fat, ash and crude fibre content of the supplemented biscuits was calculated by using nutritional composition (Gopalan *et al.,* 2004) of all the ingredients used for preparation of biscuits and are presented on per cent basis.

The organoleptic evaluation of the supplemented biscuits was also carried out to adjudge the consumer's acceptability. The prepared biscuits were subjected to a panel of ten judges for evaluation of various sensory attributes such as colour, flavour, texture and overall acceptability (Larmond, 1977).

OBSERVATIONS AND ASSESSMENT

The values pertaining to the physical parameters of buckwheat samples procured from Mountain Agricultural Research and Extension Centre, Sangla of CSK Himachal Pradesh Agricultural University Palampur are presented in Table 1. As is evident from the data, the values of weight as 1000 kernel weight of different varieties varied from 20.67 to 22.79 g. The length and width varied from 0.46 to 0.56 cm and 0.28 to 0.31 cm, respectively. Among the various samples analyzed SMLBW-4 had maximum density (1.22 g/ml) whereas OC-2 had minimum density (1.12 g/ml). All the buckwheat samples were triangular in shape and brownish in colour.

The data of proximate characteristics of buckwheat

Table 1 : Physical characteristic of buckwheat samples

Sr. No.	Parameters	Colour	Shape	1000 kernel weight (g)	Length (cm)	Width (cm)	Density (g/ml)	Bulk density (g/ml)
1.	Himpriya	Brown	Triangular	20.67	0.46	0.29	1.14	0.64
2.	OC-2	Brown	Triangular	22.48	0.56	0.31	1.12	0.68
3.	IC-341593	Brown	Triangular	22.79	0.54	0.30	1.16	0.73
4.	Sangla B-1	Brown	Triangular	22.77	0.53	0.29	1.16	0.64
5.	Sangla B-118	Brown	Triangular	20.76	0.53	0.29	1.13	0.73
6.	SMLBW-4	Brown	Triangular	22.40	0.55	0.28	1.22	0.73

Table 2 : Proximate composition*(%) of buckwheat samples

Sr. No.	Samples	Protein	Fat	Ash	Crude fibre	Carbohydrates
1.	Himpriya	10.48	4.66	3.65	2.60	78.61
2.	OC-2	10.30	4.01	3.67	3.19	78.83
3.	IC-341593	10.63	4.13	3.56	3.65	78.03
4.	Sangla B-1	9.73	4.17	4.22	3.23	78.65
5.	Sangla B-118	10.63	4.52	3.42	3.05	78.38
6.	SMLBW-4	10.52	4.44	3.94	3.82	77.28

Values are on 100 % dry weight basis

Table 3 : Chemical characteristics* of buckwheat samples

Sr. No.	Samples	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Free amino acids (%)	Free fatty acid (%)	Trypsin inhibitor (TIU/g)
1.	Himpriya	8.37	4.58	3.79	1.42	0.30	5.76
2.	OC-2	7.97	4.46	3.15	1.36	0.32	5.82
3.	IC-341593	8.36	4.69	3.67	1.44	0.32	5.79
4.	Sangla B-1	8.15	4.56	3.59	1.20	0.31	5.85
5.	Sangla B-118	8.10	4.62	3.48	1.43	0.32	5.87
6.	SMLBW-4	8.27	4.62	3.65	1.32	0.31	5.89

*Values on 100 % dry weight basis

Table 4 : Functional properties of dough of various blends and evaluation of supplemented biscuits

Parameters	Proportions RWF and buckwheat flour used				
	100:0	90:10	80:20	70:30	60:40
Dough handling	NS	NS	NS	NS	NS
Rolling ability	Easy	Easy	Easy	Easy	Easy
Top score (on 4.0 basis)	3	3	3	3	3
Length (cm)*	17.5	17.7	17.0	17.6	17.6
Thickness (cm)*	2.9	2.4	2.6	2.7	2.6
Spread factor (cm)	6.03	7.38	6.54	6.52	6.77
Weight of Biscuit (g)	28	25	25	25	24

NS: Non- sticky, *A set of three

samples is presented in Table 2. The protein content of buckwheat samples varied from 9.73 to 10.63 per cent.

Maximum fat content (4.66 %) was observed in Himpriya variety and minimum (4.01 %) was observed in OC-2 variety. The ash content of Sangla B-1 variety was maximum (4.22 %) and that of Sangla B-118 was minimum (3.42 %). Similarly, the crude fibre content of different varieties ranged between 2.60 and 3.82 per cent with minimum and maximum values present in Himpriya and SMLBW-4, respectively. The total carbohydrate content of the samples ranged between 77.28 to 78.83 per cent. Almost similar results for protein, fat and ash

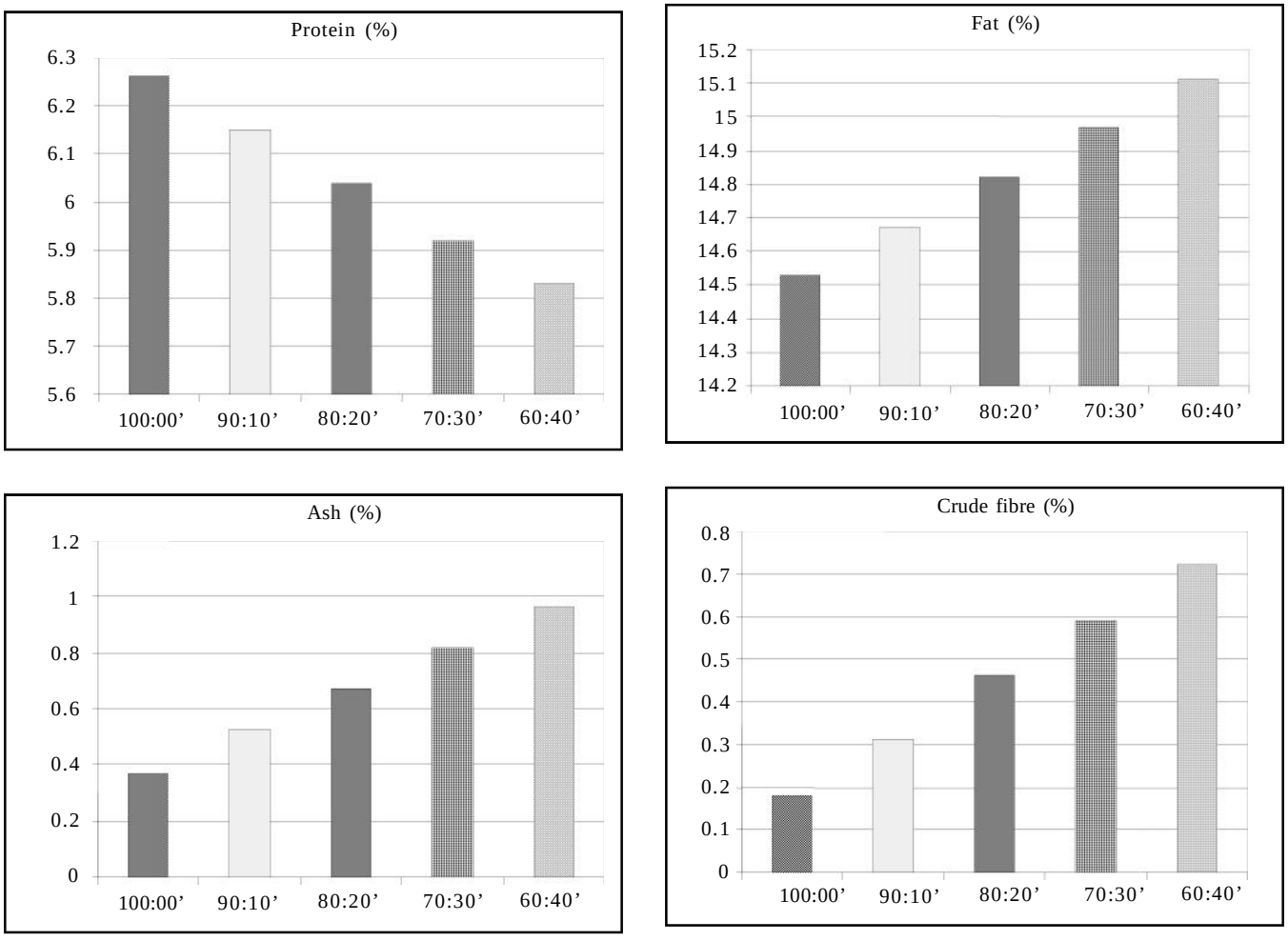

Fig. 1: Effect of buckwheat supplementation on the nutritional profile of biscuits

content were reported by Gopalan *et al.* (2004); Sharma (2006) and Eggum *et al.* (1981), respectively in buckwheat grains.

The data pertaining to sugar, free fatty acid, free amino acid and trypsin inhibitor activity of buckwheat samples are presented in Table 3. Maximum values of total, reducing and non-reducing sugars were 8.37, 4.69 and 3.79 per cent for Himpriya, IC-341593 and Himpriya, respectively whereas, minimum of 7.97, 4.46 and 3.15 per cent were recorded for OC-2 variety. The values for trypsin inhibitors activity ranged between 5.76- 5.89 TIU/g and minimum value was observed in Himpriya and maximum in SMLBW-4. The free amino acid content of Sangla B-1 was maximum (1.20 %) and that of IC-341593 was maximum (1.44 %), whereas the free fatty acid content of all the samples was almost same and ranged between 0.30 to 0.32 per cent.

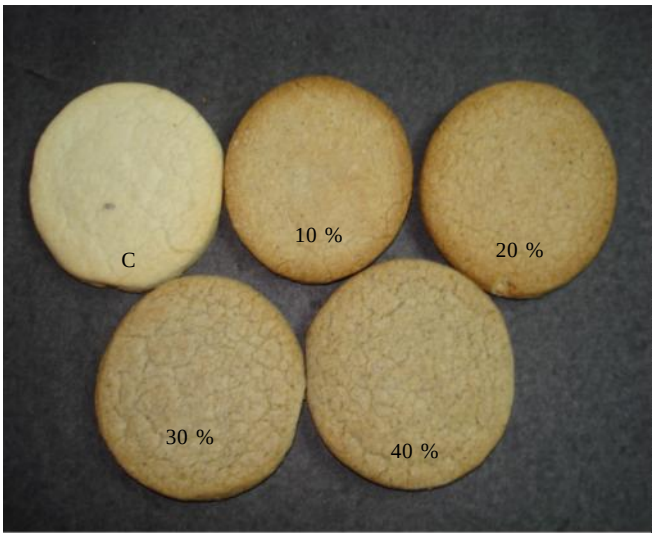

Plate 1: Physical appearance of biscuits supplemented with buckwheat flour

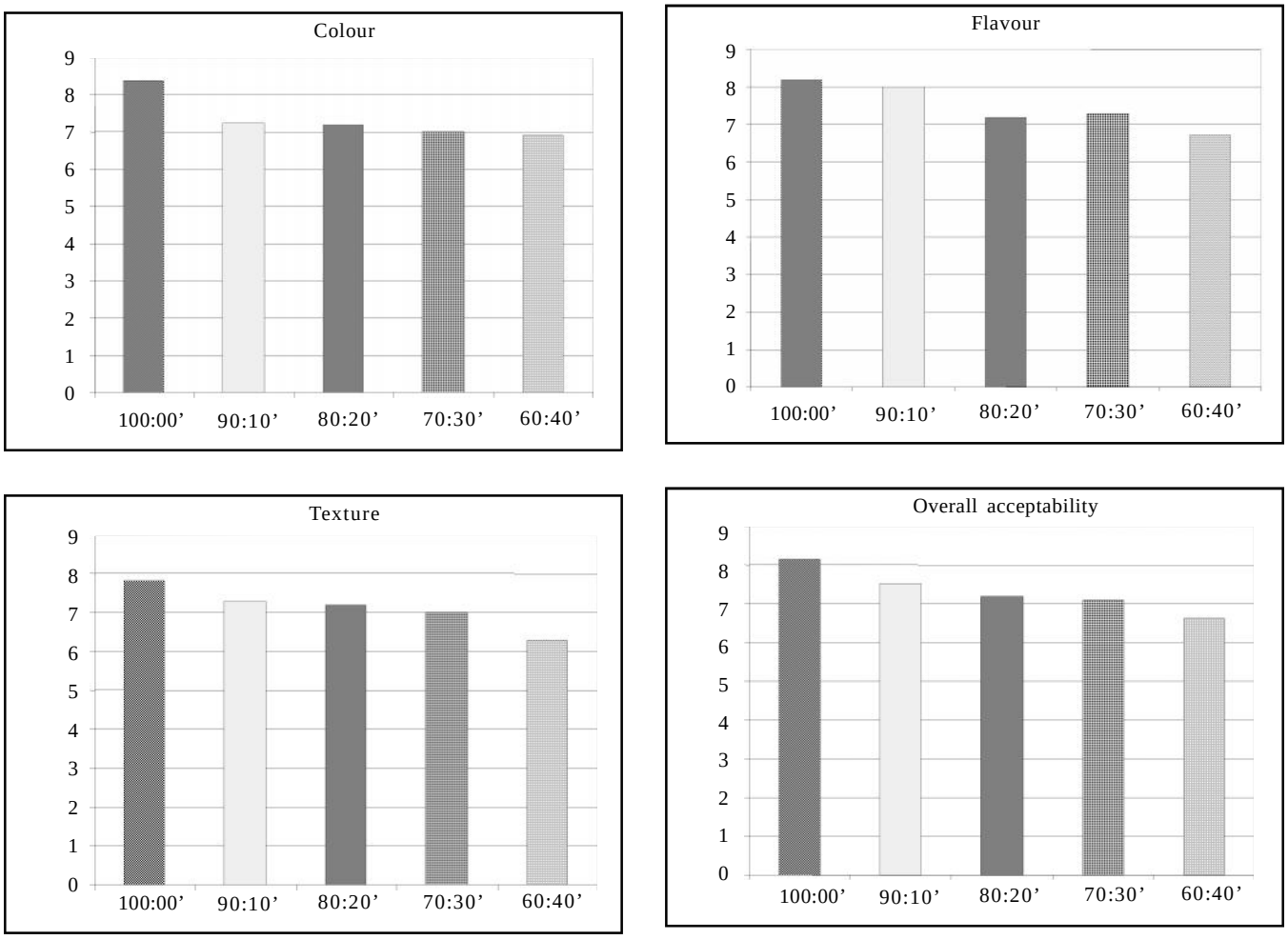

Fig. 2: Effect of buckwheat supplementation on the organoleptic acceptabillity of biscuits

Functional properties of dough prepared from various blends and evaluation of buckwheat supplemented biscuits:

The functional properties of dough prepared from the composite flours were evaluated in terms of texture of dough (Table 4). As is evident from the data the dough prepared from various composite flours using shortening was non- sticky and easy to handle. The top score of all the blends was same whereas, the length and thickness of a set of three biscuits varied slightly and ranged between 17.00 to 17.70 cm and 2.40 to 2.90 cm, respectively.

Effect of buckwheat supplementation on the nutritional profile of the supplemented biscuits:

As is evident from the Fig. 1, the protein content of the biscuits decreased slightly (6.88 % even after 40% supplementation) with the addition of buckwheat but the fat, ash and crude fibre content of biscuits increased with increase in level of supplementation and with 40 per cent supplementation the corresponding values increased upto 15.10, 0.95 and 7.3 per cent, respectively. Improvement of nutritional quality of cereal based snack foods through fortification has been reported by several workers (Prathima and Yadav, 2000; Singh *et al.*, 2000 and Marconi and Carcea, 2001).

Organoleptic evaluation of supplemented biscuits:

The prepared products were evaluated for organoleptic acceptability by a panel of ten judges on nine point hedonic scale and the effect of supplementation of buckwheat on the sensory acceptability of biscuits is presented in Fig. 2. Although the scores of various sensory attributes *viz.*,colour, flavour, texture and overall acceptability decreased with increase in level of supplementation but the values ranged between liked very much to liked moderately. Similar studies on utilization of underutilized crops like buckwheat for preparation of acceptable value added products have been reported by a number of researchers in literature (Agarwal, 1990 and Sharma, 2006).

It can concluded that biscuits are ready to eat, convenient and inexpensive food products that have low moisture contents, significant amounts of fat and long shelf-life. When prepared from nutritional view point such nutritious snacks can be used effectively in child feeding programmes and as a supplement to the diets of the elderly and low income groups of population.

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