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Sensory and nutritional evaluation of *biscuits* Prepared from pearl millet (*bajra*)

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Abstract
The present study was undertaken with the objectives of evolving *biscuits* containing *bajra* to find out their acceptability and nutritive value. *Biscuits* were prepared by using whole wheat flour, *bajra* flour, sugar, ghee by substituting whole wheat flour with *bajra* flour. The different samples prepared were Type A, Type B, Type C, Type D and Type E in the ratios of (whole wheat flour:*bajra* flour) 100, 75:25, 50:50, 25:75, 100 respectively. The developed *biscuits* were sensory evaluated using nine point hedonic scale. Results showed that biscuit Type E was highly acceptable as scored (8.4±0.09) whereas biscuit Type B was least acceptable as scored (7.5±0.03). Highest energy, fat and iron were observed in Type E (1010 Kcal), (55 g) and (8 mg) respectively. Likewise fat, protein, carbohydrate, fibre and calcium were observed in Type B (68.3 g), (11.9 g), (118.5 g), (1.7 g) and (52.5 g) respectively. Biscuit (Type E) was most acceptable and analysed for proximate and mineral content along with standard biscuit (Type A). Result shows that biscuit prepared with *bajra* flour (Type E) was found to be high in carbohydrate (56.4 g), fat (23.2±0.1 g) and iron (9.4±0.2 mg) than standard biscuit (Type A). Thus replacement of traditional food like whole wheat flour with *bajra* flour for preparing *biscuits* is feasible and beneficial too and also were very well accepted.

Keywords: hedonic scale, pearl millet, nutritive value

Introduction
Biscuit is most popular bakery product worldwide. It is an unleavened crisp, sweet pastry made from wheat flour, shortening & sugar, and is usually made light by the addition of baking powder. Because of its acceptability in all age group, longer shelf life, better taste and its position as snacks it is consider as a good product for nutritional improvement (Gayas *et al*., 2012) [4].

Pearl millet (*bajra*) is an important coarse cereal crop in western India (Gujarat, Rajasthan and Haryana (Amarender *et al.*, 2013) [1]. It has potential for future human use due to its tolerance to difficult growing conditions such as drought, low soil fertility and high temperature and can be grown in areas where other cereal crops, such as maize (*Zea mays*) or wheat (*Triticum aestivum*), would not survive. Pearl millet (*bajra*) contains substantial amount of minerals such as iron, calcium, zinc and high level of fat, it is nutritionally comparable and even superior to major cereals due to the energy and protein value (Fasasi 2009) [3]. Owing to lack of institutional support for millet crops in contrast to the institutional promotion of wheat, rice and maize continue to shrink the millet-growing region. While, pearl millet (*bajra*) is nutritious, it is underutilized in developed countries due to non-availability in convenient/ ready to eat form (Obilana 2010). The objectives of this work were to prepare *biscuit* with different proportions of wheat flour and *bajra* flour, to characterize their nutritional value, and to evaluate the *biscuit* acceptance by panel member.

Methodology
Procurement of pearl millet
Pearl millet was procured from Sector-15 Market, Chandigarh.

Processing of pearl millet (*bajra*)
The clean and healthy grain of pearl millet (*bajra*) was used for preparation of flour. They were roasted in a pan and then ground with the help of electric grinder. Then the ground content was sieved through a mesh sieve to obtain flour. The powdered sample was stored in air tight container until further use for experiments.

Standardization and development of *biscuits*
Formulation was prepared by blending whole wheat flour and *bajra* flour in different proportions. Table 1 depicted different combinations of flour of whole wheat flour and *bajra* flour.

Table 1: Proportion of *biscuits*

Sr. No.	Ingredients	Type A	Type B	Type C	Type D	Type E
1.	Whole wheat flour	100	75	50	25	-
2.	*Bajra* flour	-	25	50	75	100

Preparation schedule for making *biscuits*
1. **S**ieve flour.
2. Add baking powder and ghee.
3. Mix well with fingers until the mixture becomes crumbled.
4. Add powdered sugar and mix it well.
5. Make smooth dough.
6. The rolled out dough should not be too thin or too thick. Using a lid or cookie cutter, cut desired shapes and makes striped design with a fork and then bake.
7. Place the biscuits on a greased tray and bake at 170 degree Celsius for 15-20 minutes or until the biscuits start browning slightly.

Sensory evaluation of *biscuits*
The developed value added *biscuits* was standardised using sensory evaluation technique with the help of 5 panel members using 9-point hedonic scale. Most acceptable level of *bajra* flour in *biscuits* was further analysed for its nutrient content.

Nutritional evaluation of *biscuits*
Nutritive values of all the *biscuits* were calculated using Nutritive Value of Indian food by (Gopalan *et al*., 2014) [5].

Estimation of proximate composition and mineral content of standard and most acceptable *biscuits*
Moisture, crude protein, fat, ash, crude fibre, iron and calcium were determined by the method of (AOAC 1980) [2] and carbohydrate (calculation).

Statistical analysis
All the obtained data of chemical analysis and sensory evaluation were statistically analyzed using Mean, Standard error, Friedman-Test according to the standard method.

Observations and Assessment
Sensory evaluation of *biscuits*
Results of sensory evaluation of *biscuits* prepared with *bajra* flour presented in (Table 2) revealed that the overall acceptability of *biscuits* ranged from 7.5-8.7. This indicated that the recipes were found under the category of 'liked moderately and liked very much. Standard *biscuit* (Type A) exhibit highest scores for all sensory attributes i.e. 8.6±0.24 (appearance), 8.6±0.24 (color), 8.8±0.2 (texture), 8.8±0.2 (flavour), 8.8±0.1 (taste) and 8.7±0.04 (overall acceptability) as compared to *biscuits* prepared with *bajra* flour. However incorporation of *bajra* flour in *biscuit* upto 100 per cent level maintains liked very much on the basis of 9 point hedonic scale. No significant differences were observed among mean rank of all types of *biscuits* in terms of all sensory parameters.

Table 2: Mean scores of sensory evaluation of *biscuits*

Type of *Biscuits*	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
Type A (W::100)	8.6±0.24	8.6±0.24	8.8±0.2	8.8±0.78	8.8±0.1	8.7±0.04
Type B (W:P::75:25)	7.8±0.58	7.8±0.58	7.6±0.51	7.8±0.58	8.2±0.1	7.5±0.03
Type C (W:P::50:50)	7.8±0.58	7.6±0.51	7.8±0.58	7.6±0.51	7.8±0.58	7.7±0.05
Type D (P::25:75)	7.8±0.58	7.6±0.51	7.8±0.58	7.8±0.58	8.2±0.19	7.8±0.01
Type E (P::100)	8.2±0.19	8.2±0.19	8.6±0.24	8.6±0.24	8.6±0.24	8.4±0.01
Friedman Test	3.714	3.789	7.579	7.900	4.468	9.021
p-value	.446	.435	.108	.095	.346	.061

Nutritional evaluation of *biscuits*

Table 3: Nutritive values of *iscuits*

Type of Biscuits	Energy (kcal)	Protein (g)	Carbohydrate (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)
Type A (W::100)	990	12.15	119.1	51.7	1.9	54	4.9
Type B (W:P::75:25)	994.9	11.95	118.5	52.4	1.7	52.5	5.6
Type C (W:P::50:50)	999.9	11.85	118.3	53.2	1.5	51.0	6.4
Type D (P::25:75)	1004.8	11.75	117.4	54	1.3	49.5	7.2
Type E (P::100)	1010.0	11.65	117.2	55	1.2	48.0	8.0

Estimation of proximate composition and mineral content of standard and most acceptable *biscuits*

Table 4: Proximate composition and mineral content of *biscuits*

Proximate Composition	Type A	Type E
Protein (g)	12.8±0.5	10.4±0.1
Carbohydrate (g)	55	56.4
Fat (g)	22.1±0.3	23.2±0.1
Fibre (g)	1.8±0.3	1.6±0.2
Moisture (%)	7.2±0.2	7.4±0.3
Ash (%)	1.2±0.1	1.0±0.2
Mineral Content		
Calcium (mg)	43.2±0.2	36.9±0.3
Iron (mg)	4.8±0.1	9.4±0.2

Conclusion
A novel *biscuits* product, fortified with *bajra* flour was successfully produced. The color of the fortified samples attained more dark color as the fortification was increased. The formulation made with up to 100 percent *bajra* flour as replacement of wheat flour had highest acceptability. Adding *bajra* flour in bakery products is a useful strategy to increase the consumption of carbohydrate and iron in the human diet. *Bajra* is low cost cereal, so it is economical. It can be used as a healthy alternative to other grain to make our diet more wholesome and nutritious.

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