

Development of pearl millet (*Pennisetum glaucum*) products

R.H. Gore, T.N. Khan and J.P. Nerlekar

Pearl millet is rich and inexpensive source of dietary fibre, protein, iron, calcium, minerals, protein, B-vitamins, potassium, phosphorus, magnesium, zinc-copper and manganese. Food based approaches have higher potential for achieving far reaching and long lasting benefits for the control of iron and other micronutrient deficiencies, therefore, there is a need to identify nutrient rich foods that can be produced inexpensively to meet the nutrient requirements for vulnerable groups. Iron content of pearl millet is 8 mg/100g. Thus, utilizing pearl millet four iron rich product were developed namely *Pearl pop*, *Pearl pop chiwada*, *Pearl pop chikki* and *Pearl pop namkeen*. Developed products were evaluated for acceptability and highly accepted variation was subjected for nutrient analysis.

Key Words : Development of iron rich products, Acceptability, Nutrient analysis

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INTRODUCTION

Pearl millet is the most widely grown millet. India is the largest producer of pearl millet. The botanical name is *Pennisetum glaucum*. It belongs to family *Poaceae*. It is known as *Bajri* in Marathi and *Bajra* in Hindi. The pearl millet grain is nutritious. It is rich in calcium and iron, folate, potassium, magnesium, copper, zinc and vitamin E and B-complex.

Pearl millet is reported to be the cheapest source of energy, protein, iron and zinc among all cereals and pulses (Roa *et al.*, 2006). It has higher protein and energy than maize or sorghum. It contain all essential amino acids

and is particularly high in lysine, methionine and cysteine. It is composed of about 75 per cent unsaturated fatty acids and 24 per cent saturated fatty acids. The nutritional composition of pearl millet is equal to wheat in its protein content and superior to wheat in fats and minerals particularly iron and calcium. But its utilization is limited due to the presence of anti nutritional factor such as phytates and polyphenols. The other major constraints are its fibrous seed coat, coloured pigments, characteristics astringents flavour and poor keeping quality (Desikachar, 1975). In India pearl millet is consumed in the form of *Chapati*, bhakri, porridge, boiled or steamed food (Manning *et al.*, 2010). *Bajra* helps to maintain cardio-vascular health and helps to reduce the acidity problems, weight loss, improve haematological profile, serum retinol level and blood glucose level.

Lifestyle changes in society have credited altogether a new market value for value added processed food products. *Bajra* has the potential to contribute for improvement of the nutritional status of community. Hence, the products were developed utilizing *Bajra* in

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combination with other food stuffs.

METHODOLOGY

Preparation of Bajra pops:

Soak *Bajra* in water for 15-20 min. Drain the water and exposed to high temperature (150°C) in traditional *Bhatti*. Allow it to cool and sieve. Four iron rich products namely *Pearl pop*, *Pearl pop chiwada*, *Pearl pop chikki* and *Pearl pop namkeen* were developed utilizing popped *Bajra* (pearl millet), roasted bengal gram *Dhal*, rajgira leaves powder, mango powder and turmeric powder. Different variations of each product were prepared and evaluated organoleptically following five point hedonic scale (Srilakshmi, 2005). Based on the results of organoleptic evaluation, highest acceptable variation from each product was selected and determined the proximate composition as per procedures prescribed by A.O.A.C. (1975). Calcium was estimated by EDTA method. Iron content was estimated by Atomic Absorption Spectrophotometer (Perkin R. Elmer Model-3110). The data was evaluated by appropriate statistical methods (Panse and Sukhatme, 1985).

OBSERVATIONS AND ASSESSMENT

The mean value of organoleptic scores for the

acceptability of pearl pop are given in Table 1. The mean score for colour of I, II, III, IV and V variations of *Pearl pop* were found to be 3.50, 3.90, 2.40, 3.00 and 3.10, respectively. The maximum score of 3.90 was obtained for colour of variation II where as the minimum score of 2.40 was recorded for colour of variation III. The score registered for the texture of *Pearl pop* was between 4.50-2.50. The maximum score was recorded by variation II and the minimum score was recorded by variation III. In conclusion it can be said that the variation II was found to be highly acceptable in terms of texture. The highest score of 4.30 for the taste was recorded by the variation II where as lowest score 2.70 was recorded by IV. The mean score secured for flavour of *Pearl pop* was ranging from 3.60-2.60. The highest score of 3.60 was secured by variation II while the minimum score of 2.60 was secured by variation IV. The mean scores for overall acceptability of *Pearl pop* variations I to V was ranging from 3.10 - 4.00. The maximum score (4.90) was obtained by the variation II, followed by I, III, V while the minimum score was obtained by variation IV. In the light of above results it can be concluded that variation II was found to be most acceptable in terms of all organoleptic characteristics as compared to other variation. Roasting has a significant impact on the quality of the final product. Roasting improves the flavour, texture

Table 1: Mean acceptability scores of organoleptic characteristics of *Pearl pop*

Variation	Colour	Texture	Taste	Flavour	Overall acceptability
I	3.50	3.70	3.40	3.30	4.00
II	3.90	4.50	4.30	3.60	4.90
III	2.40	2.50	3.10	2.80	3.00
IV	3.00	2.80	2.70	2.60	2.60
V	3.10	2.80	2.80	2.90	3.10
'F' value	16.39**	29.84**	16.74**	7.80**	62.20**
S.E.±	0.13	0.15	0.15	0.14	0.11
C.D. (P=0.05)	0.38	0.41	0.43	0.39	0.32

* and ** indicate significance of values at P=0.05 and 0.01 respectively

NS = Non- significant

Table 2: Mean acceptability scores of organoleptic characteristics of *Pearl pop chiwada*

Variation	Colour	Texture	Taste	Flavour	Overall acceptability
I	3.90	3.80	3.30	3.50	4.00
II	4.30	5.00	4.90	4.40	5.00
III	2.90	2.70	2.60	2.70	2.70
IV	2.60	2.50	2.80	2.80	2.70
V	2.60	2.40	2.40	2.80	2.30
'F' value	32.22**	64.72**	29.65**	23.07**	90.92**
S.E.±	0.13	0.13	0.18	0.15	0.11
C.D. (P=0.05)	0.38	0.38	0.51	0.41	0.32

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS = Non- significant

and nutritive value of the grains.

The mean value of organoleptic scores for the acceptability of *Pearl pop chiwada* are given in Table 2. The mean scores of colour of *Pearl pop chiwada* for variation I, II, III, IV and V were found 3.90, 4.30, 2.90, 2.60 and 2.60, respectively. The maximum score of 4.30 was obtained for colour of variation II followed by 3.90 for variation I. On the other hand, the lowest score of 2.60 was attended by variation IV and V. The colour of the product is very important from consumer point of view because it is the colour, which appeal first to a person to purchase or consume any food.

The mean scores obtained for texture of *Pearl pop chiwada* were found to be between 5.0 to 2.40. The maximum score was obtained by variation II and followed by variation I. The minimum score was obtained by variation V.

The scores registered for the taste of *Pearl pop chiwada* were between 4.90 to 2.60. The highest score of 4.90 for the taste was recorded by the variation II. Statistically significant difference was not recorded in the variation III, IV and V for the taste. The scores secured for flavour of *Pearl pop chiwada* was ranging from 4.4 to 2.70. The highest score for the flavour was secured by variation II followed by I while the minimum

score was 2.70 variation IV and V similar scores. On the other hand recorded the score of variation III was at par with the IV and V.

The mean scores for overall acceptability of *Pearl pop chiwada* were found to be for variation I, II, III, IV and V were 4.0, 5.0, 2.70, 2.70 and 2.30, respectively. The maximum score (5.0) was obtained by the variation II followed by variation I was 4.0 while the minimum score 2.30 was obtained by the variation V.

From the result, it can be said that variation II of *Pearl pop chiwada* was found to be most acceptable in terms of all the organoleptic characteristics. The variation III and IV secured similar scores.

Roasting improves the flavour, texture and nutritive value of the grains (Siegal and Fawcett, 1976), eliminate most of anti-nutritional or toxic effects.

The mean scores for organoleptic characteristics of *Pearl pop chikki* are presented in Table 3. Wide variations were noticed among the mean scores of colour of *Pearl pop chikki*. The colour of the prepared *Pearl pop chikki* was ranging from 4.0 to 2.40. The highest score (4.0) was obtained by variation III where as the lowest score (2.40) was secured by variation V.

The highest score 5.0 was recorded for texture of pearl pop chikki whereas, the lowest score 2.70 was

Table 3: Mean acceptability scores of organoleptic characteristics of *Pearl pop chikki*

Variation	Colour	Texture	Taste	Flavour	Overall acceptability
I	3.50	4.00	4.30	3.60	3.90
II	3.50	3.80	3.20	2.90	3.00
III	4.0	5.00	4.80	4.00	5.00
IV	2.90	2.70	2.90	2.10	2.50
V	2.40	2.80	2.60	2.20	2.50
'F' value	20.76**	76.24**	37.91**	17.77**	87.48**
S.E.±	0.13	0.10	0.15	0.19	0.11
C.D. (P=0.05)	0.37	0.30	0.42	0.55	0.31

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS = Non- significant

Table 4: Mean acceptability scores of organoleptic characteristics of *Pearl pop namkeen*

Variation	Colour	Texture	Taste	Flavour	Overall acceptability
I	3.60	3.60	3.40	3.40	3.70
II	3.00	3.00	3.00	2.40	2.90
III	2.40	2.20	2.50	2.80	2.40
IV	3.70	4.20	4.20	3.40	4.10
V	2.30	2.60	2.20	2.50	2.00
'F' value	21.25**	23.70**	27.53**	7.78**	33.51**
S.E.±	0.14	0.16	0.14	0.17	0.15
C.D. (P=0.05)	0.39	0.45	0.41	0.47	0.41

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS = Non - significant

recorded by variation IV which was found significant statistically. On the whole the texture of pearl pop chikki of variation III was found to be most acceptable. The texture of variation IV and V did not differ significantly. The scores for taste of pearl pop chikki variations ranged from 4.80 to 2.60. The highest value 4.80 was recorded for the taste by pearl pop chikki variation III. The lowest value 2.60 was recorded for the taste by variation V.

The score for the flavour of pearl pop chikki for variation I, II, III, IV and V were 3.60, 2.90, 4.0, 2.10 and 2.20, respectively. Maximum score of 4.0 for flavour was obtained by variation III. While, minimum score 2.10 was obtained by variation IV. Statistical results revealed the variation IV and V did not differ significantly.

The mean values of overall acceptability of pearl pop chikki variations were ranging from 5.0 to 2.50. The maximum score (5.0) for overall acceptability was secured by variation III. While the minimum score (2.50) was recorded by variation IV and V. On analyzing values statistically, it was noticed that the scores for overall acceptability of pearl pop chikki variations I, II, III and IV differed significantly from each other whereas the overall acceptability score of variation IV and V were similar. In the light of above results, it can be concluded that the scores obtained for colour, texture, flavour, taste and overall acceptability of pearl pop chikki variation III was more than others.

The mean score for organoleptic characteristics of pearl pop namkeen are presented in Table 4. The mean scores for colour of pearl pop namkeen prepared indifferent combination varied from 3.70 to 2.30. The pearl pop namkeen variation IV recorded more score (3.70) while less score was recorded (2.30) for variation V. The

scores obtained for texture of pearl pop namkeen were 3.60, 3.0, 2.20, 4.20 and 2.60 for I, II, III, IV and V variation, respectively. The highest score (4.20) recorded by variation IV while the lowest score of 2.20 was recorded by the variation III. The maximum score (4.20) was recorded for taste by variation IV followed by (3.40) variation I whereas minimum score was obtained by variation V (2.20). On the whole it can be said that mean scores for taste of pearl pop namkeen variations between I and II and between III and V did not differ significantly. On the other hand variation IV differed significantly from all the variations. In case of flavour pearl pop namkeen variation scores ranging from 3.40 to 2.40. The highest value was recorded for flavour by the variation IV. The lowest value obtained by the variation II. With regard to overall acceptability, the scores of all the prepared variations were ranging from 4.10 to 2.0. The maximum score of 4.10 for overall acceptability was registered by the variation IV. While the minimum score of (2.00) was registered by the variation V. The score of overall acceptability of pearl pop namkeen differed significantly from each other except between variation III and V. From the above results it can be said that variation IV scored highest for all the organoleptic characteristics in the preparation of pearl pop namkeen. Among the V variations of iron rich product, the highly accepted variation in terms of organoleptic characteristics were analyzed for nutrient content.

The nutrient content of iron rich products viz., moisture (g %), protein (g %), fat (g %), total mineral (g %) and fibre (g %) were analyzed and is presented in Table 5.

The moisture content was ranged from 5.6 to 3.3 g/

Table 5 : Nutrient composition of developed pearl pop products per 100g (Dry weight basis)

Sr. No.	Name of the product	Moisture (g)	Protein (g)	Fat (g)	Total mineral (g)	Fibre (g)
1.	<i>Pearl pop</i>	5.6	8.7	1.6	2.9	1.4
2.	<i>Pearl pop chiwada</i>	4.6	12.9	1.8	3.1	1.3
3.	<i>Pearl pop chikki</i>	3.3	8.3	2.9	3.7	1.2
4.	<i>Pear pop namkeen</i>	3.6	7.1	2.6	1.1	1.3

Table 6 : Mineral composition of developed pearl pop products per 100g (Dry weight basis)

Sr. No.	Name of the product	Calcium (mg)	Iron (mg)
1.	<i>Pearl pop</i>	168	16.0
2.	<i>Pearl pop chiwada</i>	184	18.2
3.	<i>Pearl chikki</i>	166	16.0
4.	<i>Pearl pop namkeen</i>	177	8.8

100 g. *Pearl pop* recorded highest value (5.6 g/100 g) followed by *Pearl pop chiwada*, *Pearl pop chikki* and *Pearl pop namkeen* was 4.6, 3.3 and 3.6 g/100 g, respectively. The protein content of iron rich product was 8.7, 12.9, 8.3 and 7.1g/100g for *Pearl pop*, *Pearl pop chiwada*, *Pearl pop chikki* and *Pearl pop namkeen*, respectively. It is clear from the result that *Pearl pop chiwada* recorded highest protein content.

The fat content of *Pearl millet* products was ranged from 2.9 to 1.6 g/100 g. *Pearl pop chikki* recorded the highest value (2.9 g/100g) while the minimum fat content (1.6g/100g) was noticed in pearl pop. The estimated value for total mineral g/100 g in *Pearl pop*, *Pearl pop chiwada*, *Pearl pop chikki* and *Pearl pop namkeen* was 2.9, 3.1, 3.7 and 1.1 g/100 g. The fibre content of *Pearl pop*, *Pearl pop chiwada*, *Pearl pop chikki* and *Pearl pop namkeen* were 1.4, 1.3, 1.2 and 1.3 g/100g was recorded.

The mineral content of developed iron rich product is presented in Table 6. The calcium content was ranged from 184 to 166 mg/100g, the iron content of developed iron rich products was 16.0, 18.2, 16.0 and 8.8 mg/100g for *Pearl pop*, *Pearl pop chiwada*, *Pearl pop chikki* and *Pearl pop namkeen*, respectively. It is clear from the result that *Pearl pop chiwada* recorded the highest amount of calcium and iron among the developed iron rich products.

Mineral elements form an important group of nutrients necessary for the growth and upkeep of the body. About four to five per cent of body weight is made up of mineral element. The minerals calcium and iron are normally included in the nutritional planning. Like vitamins, minerals cannot be synthesized by human body and must be provided in a diet which are necessary for the regulatory system for efficient metabolism of protein, fat and other regulatory functions, but the trace element are found to be deficient in the diet of population.

Conclusion:

It was inferred from the results that development of iron rich products by utilizing pearl millet provides more amount of nutrients like protein, iron, calcium and fibre. Among all the developed products *Pearl pop chiwada* was highly accepted and recorded highest protein, calcium and iron content. Since the developed products had good

amount of protein and mineral hence, could be utilized as mid day meal in different feeding programme to overcome malnutrition in developing countries. Supply of trace elements in the diet is of great current interest to the nutrition of the community because of increasing evidence of their marginal or inadequate intake among different segments of the population. Thus, the developed iron rich products could be recommended as health foods for all age groups because consumption of nutrient dense foods not only help to improve the nutritional status but also provide further health benefits.

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