

## DEVELOPMENT OF VALUE ADDED PRODUCT OF PEARL MILLET FOR ORGANOLEPTIC ACCEPTABILITY

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### SUMMARY

Green leafy vegetables (GLVs) are micro nutrient-dense and promote health. These are good source of fiber, vitamins, minerals and antioxidants that help to protect us against deficiency diseases. Being rich in micro nutrients, in the present study the powder of leaves of the GLVs was utilized for the preparation of pearl millet biscuits and thereby improving their nutritive value. The organoleptic evaluation of supplemented biscuits indicated that pearl millet biscuits prepared using spinach and carrot twigs powder at 10 per cent level of supplementation had better overall acceptability than biscuits with 20 and 30 per cent level of supplementation. Incorporation of spinach and carrot twigs powder in pearl millet biscuits resulted in increase in protein (from 8.4 to 9.93%), ash (from 2.26 to 2.63%), fibre (from 0.37 to 1.43%), iron (from 2.76 to 2.47mg/100g), and calcium (from 55.25 to 81.59mg/100g).

**Key words :** Value addition, biscuits, nutritional, organoleptic, pearl millet

Pearl millet is one of the most important millet, which is superior to major cereals with reference to energy value, high quality proteins, fat and amino acids (Bhardwaj *et al.*, (2015). Besides, it is also a rich source of dietary fibers, vitamins, antioxidants and micro nutrients, Arya *et al.* (2013). In addition to their nutritive value, several potential health benefits such as delaying gastric emptying, supplying gastrointestinal bulk, preventing cancer, cardiovascular diseases, reducing tumor incidence, lowering blood pressure, risk of heart diseases, cholesterol and slow rate of fat absorption have been reported for pearl millet (Gupta and Nagar, 2010). Now-a-days, value addition is gaining lot of attention among scientists who are working continuously to develop nutrient dense products from cereals and pulses (Pandey and Sangwan, 2016).

Pearl millet could be easily supplemented with GLVs powder to develop value added products like biscuits. It is one of the most popular bakery products, which is an unleavened crisp, sweet pastry made from cereal/millet flour, fat, sugar and baking powder. These are made from pearl millet with incorporation of spinach and carrot twigs powder not only make it more delicious, but better bakery product from the health view point. Therefore, this study was conducted to utilize green

leafy vegetables powder as an ingredient in the value addition of pearl millet, which may have good consumer acceptability and increased nutritional value. Moreover, these are also highly acceptable for pet animals.

The pearl millet grains collected from the Bajra Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar. Grains of pearl millet were cleaned to remove soil, dust and other foreign materials and milled to a fine powder and stored in air-tight plastic container till further use. Green leafy vegetables (spinach and carrot twigs) were purchased from local market. The leaves thoroughly washed in water 2-3 times to remove the adhering dust and impurities and excess water drained and dried in solar tunnel dryer. The solar dried green leafy vegetables were milled to fine powder and packed in air-tight container for further use.

The pearl millet biscuits developed with the incorporation of spinach and carrot twigs powders at different supplementation levels i.e. 10, 20 and 30 per cent. Table 1 gives description of ingredients used for preparation of biscuits. The flow chart for biscuit preparation is presented in Fig. 1. Developed biscuits were organoleptically evaluated by a panel of ten judges from I.C College of Home Science, CCS Haryana Agricultural University employing 9-Point

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TABLE 1  
Ingredients used for preparation of biscuits

Ingredients	Types of Biscuits			
	Control	Type I	Type II	Type III
Pearl millet flour (g)	75	75	75	75
Refined Flour (g)	75	75	75	75
Spinach powder/Carrot twigs powder (g)	-	10	20	30
Ghee (g)	100	100	100	100
Sugar (g)	80	80	80	80
Milk (ml)	25	25	25	25
Baking powder	A pinch	A pinch	A pinch	A pinch
Ammonium bicarbonate	¼ tsp	¼ tsp	¼ tsp	¼ tsp
Sodium bicarbonate	A pinch	A pinch	A pinch	A pinch

Hedonic Scale. Average of scores for all sensory characteristics, viz., color, appearance, flavor, texture and taste expressed in terms of overall acceptability.

The nutrient composition (protein, fat, ash and crude fibre) of the developed biscuits were determined using the recommended methods of AOAC (2005). The carbohydrate content was determined by the difference method. The iron and calcium contents were analyzed by spectrophotometric method using the diacid extract according to the method of Lindsey and Norwell (1969).

### Organoleptic evaluation

The results of organoleptic acceptability of pearl millet biscuits incorporating spinach powder are presented in Table 2. The mean scores for colour, appearance, aroma, texture, taste and overall acceptability of pearl millet biscuits (control) were 'liked very much' by the judges, whereas, 10 and 20 per cent spinach powder supplemented pearl millet biscuits were 'liked moderately'. Pearl millet biscuits supplemented with 10 per cent spinach powder had the highest mean scores for all sensory attributes followed by 20 and 30 per cent supplementation level. The mean scores for colour, taste and overall acceptability of pearl millet biscuits having 30 per cent spinach powder fell in the category of 'liked slightly' by the panel of judges, whereas, appearance, aroma and texture fell in the category of 'liked moderately'.

The mean scores for overall acceptability of 10 and 20 per cent spinach powder supplemented pearl millet biscuits were 7.75 and 7.40, respectively. Supplementation of spinach powder in pearl millet biscuits upto 20 per cent level was found organoleptically acceptable after that overall acceptability score fell to 6.92 in 30 per cent spinach powder supplemented pearl millet biscuits.

The mean scores for colour, appearance, aroma, texture, taste and overall acceptability of pearl millet biscuits prepared incorporating 10, 20 and 30 per cent carrot twigs powder were 'liked moderately' by the judges (Table 3). Their overall acceptability scores ranged from 7.08 to 7.78. Pearl millet biscuits supplemented with 10 per cent carrot twigs powder had the highest mean scores for all sensory attributes. Supplementation of carrot twigs powder in pearl millet biscuits upto 30 per cent level has found organoleptically acceptable. Florence-Suma *et al.* (2014) indicated that the pearl millet cookies had higher overall quality score compared to control wheat flour cookies. Singh *et al.* (2007) also found that addition of dehydrated bathua leaves was organoleptically acceptable in different proportions in different recipes. Similarly, Nwakalor and Chizoba (2014) also reported that in terms of sensory acceptability scores, the best moringa flour substitution for making wheat flour cookies was 10 and 20 per cent. Joshi and Mathur (2010) also reported that leaf mixture products are best acceptable at 10 per cent level of substitution. Haque *et al.* (2016) reported that sensory attributes of biscuits with 10 per cent replacement of cabbage powder with refined wheat flour had found more acceptable.

### Nutrient composition

The results of nutrient composition of pearl millet biscuits incorporating spinach and carrot twigs powder are presented in table 4. The protein, fat, ash, fibre and carbohydrate content of control pearl millet biscuits were 8.40, 28.52, 2.26, 0.37 and 60.45 per cent, while, iron and calcium content were 2.76 and 55.25

TABLE 2  
Organoleptic acceptability of pearl millet biscuits prepared by incorporating spinach powder

Supplementation level of spinach powder	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control	8.20	8.20	8.10	8.20	8.30	8.20
Type I (10%)	7.80	7.60	7.80	7.70	7.80	7.75
Type II (20%)	7.50	7.30	7.70	7.30	7.20	7.40
Type III (30%)	6.90	7.00	7.10	7.10	6.50	6.92

Values are mean of ten observations.

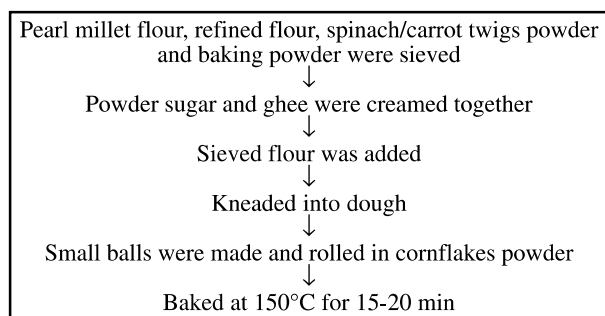


Fig. 1. Flow chart for biscuit preparation.

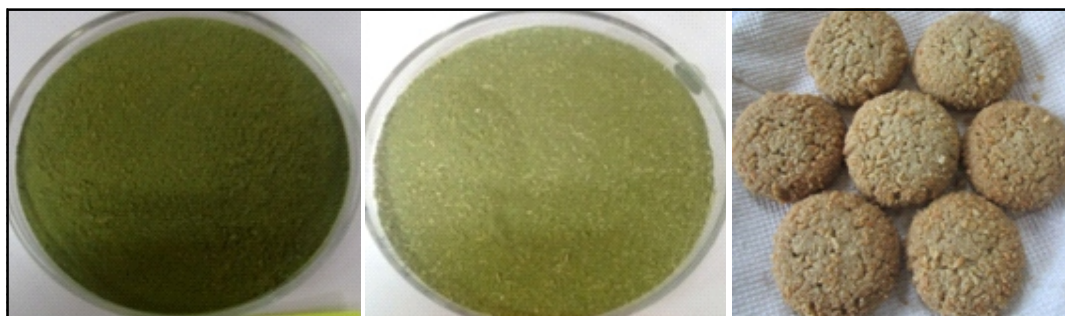
TABLE 3  
Organoleptic acceptability of pearl millet biscuits prepared by incorporating carrot twigs powder

Supplementation level of carrot powder	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control	8.20	8.20	8.10	8.20	8.30	8.20
Type I (10%)	7.90	7.70	7.70	7.70	7.90	7.78
Type II (20%)	7.70	7.60	7.60	7.50	7.70	7.62
Type III (30%)	7.10	7.10	7.00	7.20	7.00	7.08

Values are mean of ten observations.

mg/100 g, respectively. Supplementation of spinach and carrot twigs powder at 10 to 30 per cent in pearl millet biscuits increased the protein, fat, ash, fibre, iron and calcium contents. The protein, fat, ash, fibre and carbohydrate content of pearl millet spinach biscuits were ranged from 8.86-9.36, 28.58-28.73, 2.48-2.59,

0.40-0.51 and 58.81-59.68 per cent, while, iron and calcium content were ranged from 2.87-3.10 and 55.98-56.47 mg/100 g, respectively. However, pearl millet carrot twigs biscuits ranged from 9.10-9.93, 28.78-28.89, 2.46-2.63, 0.56-1.43 and 57.12-58.90 per cent and 3.64-4.47 and 66.25-81.59 mg/100 g, respectively.



Spinach Powder

Carrot twigs powder

Pearl millet biscuits (Control)

Spinach powder supplemented pearl millet biscuits



Type I (10%)

Type II (20%)

Type III (30%)

Carrot twigs powder supplemented pearl millet biscuits



Type I (10%)

Type II (20%)

Type III (30%)

TABLE 4  
Nutrient composition of pearl millet biscuits incorporating spinach powder and carrot twigs powder

Supplementation level	Protein (%)	Fat (%)	Ash (%)	Fiber (%)	Carbohydrates (%)	Iron (mg/100 g)	Calcium (mg/100 g)
<b>Control Pearl millet Biscuits</b>	8.40	28.52	2.26	0.37	60.45	2.76	55.25
<b>Pearl millet biscuits prepared using spinach powder</b>							
Type I (10%)	8.86	28.58	2.48	0.40	59.68	2.87	55.98
Type II (20%)	8.98	28.65	2.51	0.45	59.41	2.98	56.39
Type III (30%)	9.36	28.73	2.59	0.51	58.81	3.10	56.47
<b>Pearl millet biscuits prepared using carrot twigs powder</b>							
Type I (10%)	9.10	28.78	2.46	0.56	58.90	3.64	66.25
Type II (20%)	9.42	28.85	2.57	1.17	57.99	3.90	75.61
Type III (30%)	9.93	28.89	2.63	1.43	57.12	4.47	81.59

Values are mean of three observations.

Pearl millet biscuits supplemented with carrot twigs powder had higher protein, fat, fibre, iron and calcium contents than pearl millet biscuits supplemented with spinach powder at all levels of supplementation. Rai *et al.* (2014) found pearl millet: sorghum cookies had high nutritional value i.e. fat (19.2%), protein (7.4%), ash (1.6%) and calorific value (481.7 Kcal/100 g) compared to control. Florence-Suma *et al.* (2014) also reported that the protein and fat content of the pearl millet cookies ranged from 8.63 and 19.71%, respectively. Joshi and Mathur (2010) reported that the protein, iron and calcium content were significantly higher in the leaf mixtures (beet-root, carrot, cauliflower and turnip) incorporated products. Chauhan and Intelli (2014) reported that, dried cauliflower green leaves due to its high iron content might be useful as supplement to make low cost iron rich recipes. Haque *et al.* (2016) reported that the nutritional compositions such as ash, carbohydrate, vitamin-C, calcium, magnesium, potassium, phosphorus of 10% cabbage powder formulated biscuit were higher than the control.

Thus, it is concluded that powders of spinach and carrot twigs to be utilized in developing pearl millet biscuits, which are not only organoleptically acceptable but also nutritionally rich in protein, fat, fibre and minerals. The consumption of these value added nutritious products could improve the nutritional status of masses and diversify the use of underutilized fodder pearl millet crop, it will be further helpful in improving the economic status of farmers.

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