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Original Research Article

Nutritional Characteristics and Sensory Evaluation of *Amorphophallus paeonifollius* Flour based Value Added Products

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A B S T R A C T

Present study was done to assess the nutritional characteristics and sensory evaluation of *Amorphophallus paeonifollius* flour based value added products. The energy, carbohydrate, fibre, calcium and iron values of chilla supplemented with 50 per cent elephant foot yam flour was the highest and respective values were 110kcal/100g, 20.33g/100g, 1.83g/100g, 62.42mg/100g and 4.43mg/100g,respectively. The supplementation of elephant foot yam flour in chilla decreased the overall acceptability score but they were still very much liked. Significant increase in energy, carbohydrate, fibre, calcium and iron was observed with increase in level of supplementation of elephant foot yam flour in dhokla and were highest in dhokla supplemented 50 per cent elephant foot yam flour and minimum in control dhokla Protein and fat values of dhokla supplemented with elephant foot yam flour was highest in control i.e., 5.90g/100g and 2.03g/100g respectively, and minimum in dhokla supplemented with 50 per cent elephant foot yam flourAs the supplementation level of elephant foot yam flour increased the cost of all the products also increased. This can be attributed to high cost of elephant foot yam flour than other basic ingredients.

Keywords

Nutritional characteristics, Sensory evaluation, Value added products

Introduction

Elephant foot yam (*Amorphophallus paeonifollius)* is a good source of energy. Its crunchy edible part chiefly comprises of complex carbohydrates and soluble dietary fibre which helps to reduce constipation, decreases bad cholesterol (LDL) levels by binding it in the intestine and lowers colon cancer risk by preventing toxic compounds in the food from adhering to the colon mucosa. The tubers are excellent source of B-complex group of vitamins. Fresh root also contains good amount of anti-oxidant vitamins and are believed to have blood purifying characteristics. They are used in medicines for the treatment of piles, asthma, dysentery and other abdominal disorders. Elephant foot yam is not only used as a vegetable but recently several value added products like pickles, dried cubes, chips, thickening agents etc. are also made and they are gaining popularity. Preparation of osmo-dehydrated slices from fresh corm and bread from flour of *Amorphophallus paeoniifolius* corm is a good source of both carbohydrate and protein (Singh *et al.*, 2012).

Tubers have a short shelf life because of their high moisture content. One of the best ways to preserve them may be by processing

methods like drying, dehydration or by obtaining flour and/or starches. Due to the reduction of moisture content by various means the shelf life of corms can be increased. Elephant foot yam is a good source of protein, starch as well as minerals. It has a great export potential since its commercial cultivation is not in other countries. The net economic return is over one lakh rupees per ha (Misra *et al.*, 2001). Tubers also serve as tonic, stomachic and appetizer (Singh et.al 2014). *A. paeoniifolius* have several medicinal properties like gastro protective ability, antioxidative, antidiarrhoeal and anti-inflammatory activity (Singh *et al.,* 2015). Root and tuber crops are the most important food crops after cereals. Tropical root crops occupy an important place in human nutrition, especially among the low-income group of population in the developing world. Food insecure households look at these crops as a major calorie contributor. Researchers have focused on investigation of structure and physicochemical properties of several underutilized tropical tuber and root starches (Jayakody *et al.,* 2007). Tuber crops contribute to energy and nutritional requirement of more than 2 billion people in developing country and will continue to do so over the next two decades. The elephant foot yams possess high photosynthetic ability coupled with the capacity to yield under poor and marginal soils and adverse weather conditions. *A.paeoniifolius* is gaining wide acceptability due to its profound medicinal properties, better cooking quality, palatability and various uses in boiled or baked forms and pickles and flours. Even the stem and flowers are used as food (Basu *et al.,* 1991).

Materials and Methods

Chilla

Ingredients: Presented in Table 1

Method

- Took flour, chopped onion, tomato and salt in a bowl and mixed well.
- Added water slowly and made a lump free batter.
- Heated a non-stick pan on medium flame. Once pan became hot greased it with about 1tsp oil and poured the ladle full of batter and spread it to make a round chillas.
- Cooked on both sides and served with chutney.

Dhokla

Ingredients: Presented in Table 1

Method

- Soaked Bengal gram dhal overnight.
- Ground the dal coarsely. Added curd, ginger-garlic paste and green chilli paste into the batter.
- Added eno and mixed well and then poured the batter into a greased aluminium bowl.
- Added little water in a pressure cooker and placed the bowl inside it.
- Covered the lid of pressure cooker (do not put whistle on the lid).
- Kept the stove on medium flame and steamed the dhokla for 25 minutes.
- Check in between and if water evaporates add water again.
- Check the dhokla by piercing knife in it.
- Cooled and then cut it into pieces.

2.4 Sensory evaluation:

Value added products were subjected to sensory evaluation with respect to color, appearance, aroma, texture, taste and overall acceptability by a panel of 10 semi trained judges, using 9 point hedonic scale.

Nutritional evaluation of developed products

The nutritional quality of the developed products was calculated by taking into consideration the chemical composition of the selected variety of elephant foot yam. The composition of other raw materials used in product preparation taken from the values given in the Food Composition Tables compiled by Gopalan et al. (2004).

Economics of the developed products

The cost of product is an important factor for the assessment of acceptability of recipes among consumer. The cost of the products was calculated by taking into consideration the cost of raw materials.

Statistical analysis of the data

The data were analyzed for percentage, mean and single factor Analysis of variance (ANOVA) was applied to find the appropriate significant difference among the different foods.

Data given in Table 3.1 shows the sensory score of chilla supplemented with elephant foot yam flour. Table shows significant difference between treatments with respect to colour, appearance and non significant difference between aroma, texture, taste and overall acceptability score of chilla.

Colour, appearance, aroma, texture, taste and overall acceptability score of control chilla was the highest and the respective scores were 8.70, 8.70, 8.80, 8.60, 8.80 and 8.72 respectively. All are in the category of "liked extremely".

There was non significant difference in the overall acceptability score of all types of chillas.

Table 3.2 shows the nutrient content (per 100g) of chilla supplemented with elephant foot yam flour with respect to energy, protein, carbohydrate fat, fibre, calcium and iron contents. Table shows significant difference between treatments with respect to protein, carbohydrate, fat, calcium, iron content whereas, non significant difference between treatments with respect to energy and fibre contents of all types of chilla.

The energy, carbohydrate, fibre, calcium and iron values of chilla supplemented with 50 per cent elephant foot yam flour was highest and respective values were 110kcal/100g, 20.33g/100g, 1.83g/100g, 62.42mg/100g and 4.43mg/100g followed by 40, 30, 20, 10 per cent and control, respectively.

Protein and fat values of chilla supplemented with elephant foot yam flour was highest in control were 4.31g/100g and 2.34g/100g respectively. With increase in supplementation level of elephant foot yam flour protein and fat content decrease significantly.

Data illustrated in Table 3.3 shows the sensory score of dhokla supplemented with elephant foot yam flour. Table shows significant difference between treatments with respect to colour, appearance, aroma, texture, taste and overall acceptability.

Addition of elephant foot yam flour significantly decreased the colour score. Colour score of control dhokla and dhokla supplemented with 10per cent elephant foot yam flour was highest (9.00 liked extremely) followed by 20, 30, 40, and 50per cent of supplementation.

Appearance score of dhokla decreased significantly with increase in level of supplementation of elephant foot yam flour. In case of control the respective score was

9(liked extremely), which decreased to 7.50 (liked very much) on 50 per cent supplementation.

Aroma score of dhokla significantly decreased with increase in supplementation of elephant root yam flour. The control dhokla had the score 9(liked extremely) which decreased to 7.80(liked very much) on 50 per cent supplementation.

Texture score of contol dhokla and dhokla supplemented with 10 per cent elephant foot yam flour was highest (9.00, liked extremely) followed by 20, 30, 40 and 50 per cent supplementation. There was significant decrease in the texture score of dhoklas on supplementation with upto 50 per cent elephant foot yam flour.

Taste score of control dhokla and supplemented with 10 per cent elephant foot yam flour was highest (9.00, liked extremely) followed by 20, 30, 40 and 50 per cent supplementation. There was significant decrease in the taste score of dhoklas.

The overall acceptability score of control dhokla and supplemented with 10 per cent elephant foot yam flour was highest (9.00, liked extremely) followed by 20, 30, 40 and 50 per cent level of supplementation with elephant foot yam flour. There was significant difference in the overall acceptability characteristics of all types of dhoklas.

Data illustrated in table 3.4 shows the nutrient content (per 100g) of dhokla supplemented with elephant foot yam flour with respect to energy, protein, carbohydrate fat, fibre, calcium and iron content. Significant increase in energy, carbohydrate, fibre, calcium and iron was observed with increase in level of supplementation of elephant foot yam flour in dhokla.

The energy, carbohydrate, fibre, calcium and iron values of dhokla supplemented with elephant foot yam flour was highest in 50per cent were 136kcal/100g, 26.89g/100g, 1.38g/100g, 89.91mg/100g and 5.96mg/100g respectively, and minimum in control dhokla and the respective values were 124kcal, 20.50g, 1.29g, 77.26 mg and 1.54 mg/100g.

Protein and fat values of dhokla supplemented with elephant foot yam flour was highest in control i.e., 5.90g/100g and 2.03g/100g respectively, and minimum in dhokla supplemented with 50 per cent elephant foot yam flour. The respective values were 4.34g and 1.48g/100g.

Table.1 Ingredients of Chilla

Supplementation level (%)	Bengal gram flour (BGF) (g)	Elephant foot yam flour (EFYF (g)	Tomato (g)	Onion (g)	Salt (g)	Oil (tsp)
Control (100%)	100	-	10	10	1½	2
BGF:EFYF						
90:10	90	10	10	10	1½	2
80:20	80	20	10	10	1½	2
70:30	70	30	10	10	1½	2
60:40	60	40	10	10	1½	2
50:50	50	50	10	10	1½	2

Ingredients of Dhokla

Supplementation level (%)	Bengal gram dal (BGD) (g)	Elephant foot yam flour(EFYF) (g)	Salt (tsp)	Ginger-garlic paste (tsp)	Green chilli paste (tsp)	Curd (g)
Control (100%)	100	-	1	1½	1	10
BGD:EFYF						
90:10	90	10	1	1½	1	10
80:20	80	20	1	1½	1	10
70:30	70	30	1	1½	1	10
60:40	60	40	1	1½	1	10
50:50	50	50	1	1½	1	10

Table.1 Sensory scores of *chilla* supplemented with elephant foot yam flour (EFYF) per 100g

Supplementation level (%) of EFYF	Colour	Appearance	Aroma	Texture	Taste	Overall Acceptability
Control	8.70	8.70	8.80	8.60	8.80	8.72
10	8.40	8.50	8.60	8.30	8.40	8.44
20	8.20	8.30	8.60	8.40	8.40	8.38
30	8.10	8.10	8.50	7.90	8.40	8.20
40	7.90	8.10	8.70	8.50	8.30	8.30
50	7.50	7.70	8.20	8.30	8.30	8.00
C.D. (0.05)	0.14	0.42	NS	NS	NS	NS

Table.2 Nutrient content of *chilla* supplemented with elephant foot yam flour (EFYF) per 100g

Supplementation level (%) of EFYF	Energy (kcal)	Protein (g)	CHO (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)
Control	103	4.31	16.03	2.34	1.05	54.90	1.24
10	106	4.22	17.09	2.27	1.06	57.14	1.87
20	108	4.01	18.03	2.18	1.06	58.89	2.51
30	109	3.73	18.88	2.07	1.07	60.37	3.16
40	110	3.43	19.55	1.95	1.08	61.23	3.77
50	110	3.14	20.33	1.83	1.09	62.42	4.43
C.D. (0.05)	NS	0.19	0.97	0.11	NS	3.09	0.18

Table.3 Sensory scores of *dhokla* supplemented with elephant foot yam flour (EFYF) per 100g

Supplementation level (%) of EFYF	Colour	Appearance	Aroma	Texture	Taste	Overall Acceptability
Control	9.00	9.00	9.00	9.00	9.00	9.00
10	9.00	9.00	9.00	9.00	9.00	9.00
20	8.00	8.30	8.30	8.30	8.40	8.26
30	8.20	8.20	8.30	8.30	8.20	8.24
40	7.90	8.10	8.10	8.10	8.00	8.04
50	7.50	7.50	7.80	7.70	7.90	7.68
C.D. (0.05)	0.41	0.42	0.42	0.42	0.42	0.42

Table.4 Nutrient content of *dhokla* supplemented with elephant foot yam flour (EFYF) per 100g

Supplementation level (%) of EFYF	Energy (kcal)	Protein (g)	CHO (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)
Control	124	5.90	20.50	2.03	1.29	77.26	1.54
10	124	5.52	21.34	1.87	1.30	78.35	2.33
20	130	5.32	22.95	1.76	1.33	82.18	3.21
30	134	5.09	24.69	1.66	1.37	86.29	4.17
40	134	4.70	25.60	1.63	1.37	87.45	5.01
50	136	4.34	26.89	1.48	1.38	89.91	5.96
C.D. (0.05)	6.18	0.25	1.27	0.09	NS	4.39	0.24

Table.5 Economics of elephant foot yam flour based value added products (per 100gm)

Supplementation level(%) of EFYF/ Product	Cost (Rs./100gm)	
	Chilla	Dhokla
Control	8.00	7.40
10	8.20	7.70
20	8.40	8.00
30	8.60	8.30
40	8.80	8.60
50	9.00	9.90

Table 3.7 shows the economics of elephant foot yam flour based value added products per 100g. Among all products the cost of product supplemented with 50 per cent elephant foot yam flour was most expensive as compared to other products and control was least expensive. As the level of supplementation of elephant foot yam flour increased the total cost of products also increased but it can be compensated with improvement in the nutritional quality of the products

Summary and conclusion

The supplementation of elephant foot yam flour in chilla decreased the overall acceptability score but they were still very much liked by the sensory panel members. The energy, carbohydrate, fibre, calcium and iron values of chilla supplemented with 50 per cent elephant foot yam flour was the highest and respective values were 110kcal/100g, 20.33g/100g, 1.83g/100g, 62.42mg/100g and 4.43mg/100g, respectively. Protein and fat values of chilla supplemented with elephant foot yam flour were highest in control i.e., 4.31g/100g and 2.34g/100g respectively. With increase in supplementation level of elephant foot yam flour protein and fat contents decreased significantly.

The overall acceptability score of control dhokla and dhokla supplemented with 10 per cent elephant foot yam flour was the highest (9.00, liked extremely). Supplementation with elephant foot yam flour significantly decreased the overall acceptability score of dhokla but still they were in the range of liked extremely to liked very much. Significant increase in energy, carbohydrate, fibre, calcium and iron was observed with increase in level of supplementation of elephant foot yam flour in dhokla and were highest in dhokla supplemented 50 per cent elephant foot yam flour and values were 136kcal/100g, 26.89g/100g, 1.38g/100g, 89.91mg/100g and 5.96mg/100g respectively, and minimum in control dhokla and the respective values were 124kcal, 20.50g, 1.29g, 77.26mg and 1.54mg/100g. Protein and fat values of dhokla supplemented with elephant foot yam flour was highest in control i.e., 5.90g/100g and 2.03g/100g respectively, and minimum in dhokla supplemented with 50 per cent elephant foot yam flour. The respective values were 4.34g and 1.48g/100g.

As the supplementation level of elephant foot yam flour increased the cost of all the products also increased. This can be attributed to high cost of elephant foot yam flour than other basic ingredients. But it can be compensated with improvement in the nutritional quality of the products. Supplementation of elephant foot yam flour upto 50 per cent in all products was acceptable for making nutritionally rich elephant foot yam based value added products.

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