Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 336-342

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7692 **Special Issue-7 pp. 336-342**
Journal homepage: http://www.ijcmas.com

Original Research Article

Effect of Supplementation of *Amorphophallus paeoniifolius* Flour on Sweet Biscuits Making Characteristics

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Keywords

Amorphophallus paeoniifolius, value addition, organoleptic characteristics, physical characteristics, nutritional properties

A B S T R A C T

The present study was done to assess the organoleptic acceptability, physical characteristics, nutritional composition of value added sweet biscuits developed from *Amorphophallus paeoniifolius* flour. There was a significant difference between treatments with respect to colour and appearance and non-significant difference between treatments with respect to aroma, texture, taste and overall acceptability score of all types of sweet biscuits. The overall acceptability score of control sweet biscuit and supplemented with 20 per cent elephant foot yam flour was highest (8.60 liked extremely). The width (cm) and thickness (cm) of sweet biscuit of control group was highest and respective values were 5.58cm and 1.16cm. The width (cm) and thickness (cm) of sweet biscuit supplemented with 50 per cent elephant foot yam flour were least i.e., 5.10cm and 0.83cm respectively. The spread ratio of sweet biscuit supplemented with 50 per cent elephant foot yam flour was highest i.e., 6.14 and least for control group i.e., 4.81. There was a significant difference between treatments with respect to protein, carbohydrate, fibre, calcium and iron and non-significant difference between energy and fat contents of all types of sweet biscuits.

Introduction

Elephant foot yam (*Amorphophallus paeoniifolius*) belongs to family Areceae and is basically a crop of South-East Asia. Elephant foot yam [*Amorphophallus paeoniifolius (Dennst.) Nicolson*] is a tropical tuber crop having high production potential and popularity as a vegetable in various delicious cuisines (Kalloo, 2006). 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 (Mishra *et al.*, 2002).

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). Optimal processing techniques and product development potential of these tuberous crop has not been utilized due to the lack of knowledge. In an attempt to increase people's preference towards this underutilized food source, there is a need to transform this into value added products such as flours or starches (Moorthy, 2002). In fortification with other nutrients, transforming the microstructure and transformation into starch could improve the functionality of food products as well as increase the storage efficiency of *A. paeoniifolius*. Flours and starch isolated from roots and tuberous crops generally have superior viscosity, higher paste clarity and less starchy flavors compared to that of cereal flours (Hung et.al, 2005).

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). To improve the use of *Amorphophallus paeoniifolius* by the food industry, much research needs to be done in order to fulfill the current limited knowledge of the functionalities and availability of acceptable food products, its nutritional components and product processing technologies (Firdouse *et al.*, 2011).

Materials and Methods

Procurement of materials

Elephant foot yam corms of two varieties namely NDA-5 and NDA-9 harvested during the month of April-May 2015 were procured from the Department of Vegetable Science, College of Horticulture, N.D.U.A.T Kumarganj, Faizabad. Other materials required for preparation of value added products were procured from the local market of kumarganj.

Development and organoleptic characteristics of value added sweet biscuits

Method

Sieved the flour and baking powder twice or thrice.

Creamed ghee and sugar.

Added flour and mixed well.

Placed dough for conditioning for 30 minutes in refrigerator.

Kneaded the dough again and rolled it into sheet. Cut into desired shape using biscuit cutter.

Baked at 160°C for about 25 minutes or till brown colour.

Physical Parameters of Biscuits

The following parameters of biscuits were determined:

Diameter

To determine the diameter (D), six biscuits were placed edge to edge. The total diameter of six biscuits was measured in cm by using a ruler.

The biscuits were rotated at an angle of 90° for duplicate reading. This was repeated once more and average diameter was recorded in centimeter.

Thickness

To determine the thickness (T), six biscuits were placed on top of one another. The total height was measured in centimeter with the help of ruler.

This process was repeated thrice to get an average value and results were reported in centimeter.

Spread ratio

Spread ratio (D/T) was calculated by dividing the average value of diameter (D) by average value of thickness (T) of biscuits.

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 (Appendix-I).

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).

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.

Results and Discussion

Table 1 shows the sensory score of sweet biscuit supplemented with elephant foot yam flour. Table shows significant difference between treatments with respect to colour and appearance and non-significant difference between treatments with respect to aroma, texture, taste and overall acceptability score of all types of sweet biscuits.

Colour score of control sweet biscuit and supplemented with 10, 20, and 30per cent elephant foot yam flour were highest and same i.e., 8.70 (liked extremely). Appearance score of control sweet biscuit and supplemented with 20 per cent elephant foot yam flour was highest (8.60 liked extremely). Aroma and taste score of sweet biscuit supplemented with 30per cent elephant foot yam flour was highest i.e., 8.60 (liked extremely) and 8.80 (liked extremely). Texture score of control sweet biscuit was highest (8.60 liked extremely). The overall acceptability score of control sweet biscuit and supplemented with 20 per cent elephant foot yam flour was highest (8.60 liked extremely).

Chandel (2014) developed products like bread and biscuits from the blends containing different proportions (10, 20, 30 and 40%) of linseed flour and evaluated them for their physical and sensory characteristics. Among the developed products, products with 30 per cent linseed flour supplementation were found most acceptable in terms of organoleptic characteristics.

Eke- Ejiofor (2013) reported that wheat flour could be substituted with African bread fruit and sweet potato flour upto 30 per cent level in biscuit making improved the nutritional and sensory properties.

Processing of material

Amorphophallus paeoniffolius

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Washing and weighing

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Peeling

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Again washing

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Grating

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Sun drying

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Milling

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Sieving

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Packaging

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Storing

Ingredients

Supplementation level (%)	Refined wheat flour (RWF) (g)	Elephant foot yam flour (EFYF) (g)	Ghee (g)	Sugar (g)	Baking powder (tsp)
Control (100%)	100	-	70	50	1
RWF:EFYF					
90:10	90	10	70	50	1
80:20	80	20	70	50	1
70:30	70	30	70	50	1
60:40	60	40	70	50	1
50:50	50	50	70	50	1

Table.1 Sensory scores of *sweet biscuit* supplemented with Elephant foot yam flour (EFYF) per 100g

Supplementation level (%) of EFYF	Colour	Appearance	Aroma	Texture	Taste	Overall Acceptability
Control	8.70	8.60	8.40	8.60	8.70	8.60
10	8.70	8.40	8.40	8.40	8.70	8.52
20	8.70	8.60	8.50	8.50	8.70	8.60
30	8.70	8.30	8.60	8.30	8.80	8.54
40	8.10	8.40	8.30	8.30	8.30	8.28
50	7.80	7.80	8.20	8.30	8.10	8.04
C.D. (P≤0.05)	0.53	0.51	NS	NS	NS	NS

Table.2 Effect of supplementation of elephant foot yam flour (EFYF) on the sweet biscuits making characteristics

Supplementation level (%) of EFYF	Width (cm)	Thickness (cm)	Spread ratio (W/T)
Control	5.58	1.16	4.81
10	5.50	1.16	4.74
20	5.30	1.13	4.69
30	5.20	1.00	5.2
40	5.16	0.95	5.43
50	5.10	0.83	6.14
C.D. (P≤0.05)	0.33	0.06	0.33

Table.3 Nutrient content of *sweet biscuit* supplemented with Elephant foot yam flour (EFYF) pr 100g

Supplementation level (%) of EFYF	Energy (kcal)	Protein (g)	CHO (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)
Control	620	4.60	55.64	42.04	0.12	12.91	1.16
10	625	4.42	56.64	41.35	0.26	21.57	2.24
20	631	4.22	57.64	41.32	0.41	30.73	3.34
30	649	3.93	59.68	40.75	0.58	40.74	4.53
40	661	3.69	61.30	40.53	0.74	50.83	5.52
50	663	3.49	61.84	40.45	0.90	60.20	6.88
C.D. (P≤0.05)	NS	0.21	0.29	NS	0.01	6.41	0.05

Table 2 shows the effect of supplementation of elephant foot yam flour on the sweet biscuits making characteristics with respect to width (cm), thickness (cm) and spread ratio. The table shows a significant decrease between treatments with respect to width (cm), thickness (cm) and significant increase in spread ratio

The width (cm) and thickness (cm) of sweet biscuit of control group was highest and respective values were 5.58cm and 1.16cm. The width (cm) and thickness (cm) of sweet biscuit supplemented with 50 per cent elephant foot yam flour were least i.e., 5.10cm and 0.83cm respectively. The spread ratio of sweet biscuit supplemented with 50 per cent elephant foot yam flour was highest i.e., 6.14 and least for control group i.e., 4.81.

Hussain *et al.*, (2006) reported that incorporation of full fat or defatted linseed flour in wheat flour affected thickness and diameter of cookies.

Chandel (2014) developed products like bread and biscuit from the blends containing different proportions (10, 20, 30 and 40%) of linseed flour and evaluated them for their physical and sensory characteristics. It was reported that thickness of linseed flour supplemented biscuits increased whereas width and spread ratio of biscuits decreased with increasing the level of linseed flour.

Data illustrated in table 3 shows the nutrient content (per 100g) of sweet biscuit supplemented with elephant foot yam flour with respect to energy, protein, carbohydrate, fat, fibre, calcium and iron

content. Table shows significant difference between treatments with respect to protein, carbohydrate, fibre, calcium and iron and no significant difference between energy and fat contents of all types of sweet biscuits.

The energy, carbohydrate, fibre, calcium and iron values of sweet biscuit supplemented with 50 per cent elephant foot yam flour was highest and respective values were 620kcal/100g, 61.84g/100g, 0.90g/100g, 60.20mg/100g and 6.88mg/100g, respectively, and minimum for control group i.e., 620kcal, 55.64g, 0.12g, 12.91mg and 1.16mg/100g, respectively.

Protein and fat values of sweet biscuit supplemented with elephant foot yam flour was highest in control were 4.60g/100g and 42.04g/100g, respectively, and least in sweet biscuits supplemented with 50 per cent elephant foot yam flour i.e., 3.49g and 40.45g/100g, respectively.

Eke-Ejiofor (2013) reported the moisture (3.00 to 6.79 %), fat (21.93 to 27.37%), ash (1.05 to 1.17%), fibre (1.00 to 2.40 %), protein (5.5 to 7.08%), carbohydrate (57.68 to 65.24 %) contents of cake prepared from blends of African breadfruit and sweet potato to wheat composite flour.

The overall acceptability score of control sweet biscuits and biscuits supplemented with 20 per cent elephant foot yam flour was highest (8.60 liked extremely). The supplementation of elephant foot yam flour slightly decreased the sensory score but still they were liked very much by panel members. The spread ratio of sweet biscuit supplemented with 50 per cent elephant foot yam flour was highest i.e. 6.14 and least for control group i.e., 4.81. The energy, carbohydrate, fibre, calcium and iron values of sweet biscuit supplemented with 50 per cent elephant foot yam flour was highest and respective values were 620kcal/100g, 61.84g/100g, 0.90g/100g, 60.20mg/100g and 6.88mg/100g, respectively, and minimum for control group i.e. 620kcal, 55.64g, 0.12g, 12.91mg and 1.16mg/100g, respectively. Protein and fat values of sweet biscuit supplemented with elephant foot yam flour were highest in control i.e., 4.60g/100g and 42.04g/100g, respectively, and least in sweet biscuits supplemented with 50 per cent elephant foot yam flour i.e., 3.49g and 40.45g/100g, respectively.

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