Greener Journal of Agricultural Sciences
Vol. 9(1), pp. 90-94, 2019
ISSN: 2276-7770

DOI Link: http://doi.org/10.15580/GJAS.2019.1.020719026
http://gjournals.org/GJAS

Dissemination, training on pigeon pea utilization and evaluation of farmers' acceptability of the products at Erin Oke, Osun state, Nigeria

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ARTICLE INFO

Article No.: *020719026*
***Type*:** *Research*
DOI: *10.15580/GJAS.2019.1.020719026*

Submitted: *07/02/2019*
Accepted: *10/02/2019*
Published: *06/03/2019*

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Keywords: *pigeon pea; enlightenment; training; improved nutrition; convenience use*

ABSTRACT

Pigeon pea, a neglected legume is a rich source of protein enhancing local staples through fortification and in addressing malnutrition. This work aims to enlighten local farmers in a maize growing area on the nutritional and health importance of pigeon pea, to train them on various ways of utilization and to evaluate farmers acceptability and perception of the crop. The method involves informing the farmers on the benefits of pigeon pea, demonstrating processing methods for developed nutritionally improved products and assessing the farmers' sensory acceptability. Farmers showed high acceptability for the products and the willingness to plant pigeon pea.

INTRODUCTION

Pigeon pea is an under-utilized tropical legume in Nigeria. It is one of the most drought tolerant legumes with the potential of mitigating the impacts of climate change in the tropics (Odeny, 2007). It is described as the only crop that yields some grains during dry spells when other legumes as field beans have wilted and dried up (Odeny, 2007). Pigeon pea offers the benefits of soil quality and fertility in replenishing nutrient depleted soils.

Pigeon pea seed is a cheap, nutritious and healthy legume of various uses with healing and medicinal value. It is a rich source of protein, fibre, minerals and vitamins (Fasoyiro *et al*, 2006). Pigeon pea improved maize protein content from about 7% to 11.2% at maize-pigeon pea fortification of 90:10 ratio and to 14.8% at 70:30 ratio (Fasoyiro *et al*, 2013). Fibre has been known to aid digestion and to be good for colon health in preventing haemorrhoid. It is being reported to be low in lipoprotein cholesterol (Mayilvaganan *et al*, 2004). Its anti-antioxidant and inflammatory properties have also been reported (Lai *et al,* 2012); also its antihyperglycermic (antidiabetic) effect has been shown by Manzo and Vitor (2017). It has been developed at IAR&T into a number of food products with cassava and maize to improve the nutritional quality of these staples (Fasoyiro and Arowora, 2013, Fasoyiro *et al,* 2013).

Food consumption patterns among rural families in Nigeria have been reported to be dominantly local staple food (Maxiya-Dixon *et al.*, 2004). Consumption of local staples without adequate source of animal proteins has been responsible for malnutrition among children which was reported to account for about 40% stunted children in Nigeria (Maxiya-Dixon *et al.*, 2004). Animal proteins have been found to be non-affordable especially by the poor; hence food fortification of high carbohydrate foods with legumes has been reported to improve the nutritional density of most foods (Potter and Hotchkiss, 1998).

There is the need for smallholder farmers in rural communities growing maize as their main staple crop to improve their diets nutritionally with locally available legumes and to be encouraged in planting. The objective of the work was to enlighten local farmers at Erin Oke on especially the nutritional benefits of pigeon pea, train farmers on various way of processing convenience foods as nutritionally improved maize local diets and snacks with pigeon pea and to evaluate the participants' sensory acceptability of the products.

MATERIALS AND METHOD

Pigeon pea seeds and maize were obtained from Bodija market, Ibadan.

Dissemination information on pigeon pea

Information on especially the nutritional importance of pigeon pea was given to the farmers to create better awareness on the legume to the farmers group. The information includes pigeon pea chemical composition especially as source of protein, minerals, vitamins, fibre and low in fat content (Fasoyiro *et al,* 2006). The legume has the unique qualities desired by people running away from fatty foods and desiring vegetable protein to animal fats. Other information includes its anti-inflammatory, anti-oxidant properties (Lai *et al*, 2012) and anti-diabetic properties Manzo and Vitor (2017). It is also cheaper in cost than soybean and cowpea. It is also useful as a biannual crop with high yield. It can also be intercropped with maize and vegetables and it also important in mitigating the effect of climate change (Odeny, 2007).

Demonstration of pigeon pea technologies

The processing technologies for the products were demonstrated during a training organized for encouraging the use and planting of pigeon pea among the farmers. Fifty five farmers were present as participants. They were trained to process pigeon pea into four categories of products:

Snacks

Maize- pigeon pea chinchin: maize flour was mixed with pigeon pea flour at ratio 90:10 to form about 400 grams of mixed flour. One tea spoon of baking powder and 50 grams of sugar were added and mixed with the flour. About 250 ml of water was used to mix the flour, and left to proof for 30 minutes before frying in hot oil for 3 min.

Maize- pigeon pea cake: Butter (100 g) and sugar (100 g) were first mixed in a bowl. Maize flour was mixed with pigeon pea flour at ratio 90:10 to form about 400 grams of mixed flour which was added. One tea spoon of baking powder, two eggs were mixed with the flour mixture. The batter was baked in a hot oven (150^0C) for 25 min.

Maize- pigeon pea biscuit: maize flour was mixed with pigeon pea flour at ratio 90:10 to form about 400 grams of mixed flour. One tea spoon of baking powder and 50 gram of sugar were added and mixed with the flour. About 100 ml of water was used to mix the flour and baked at 150^0C for 15 min.

Traditional products:

Fermented pigeon pea spice (iru): Processing was demonstrated as frying of pigeon pea seeds for 10-15 min, and boiling for 45 min, spreading the beans thinly on a plaintain leaf-lined calabash and keeping in a warm place (27 ± 2^0C) (Fasoyiro *et al*, 2009).

Pigeon pea akara (traditional cake): Whole pigeon pea flour was prepared using Fasoyiro *et al* (2006) in which pigeon pea seeds were soaked in warm water for 15 min and then dehulled by hand. The dehulled seeds were then spread on thin aluminium containers and allowed to dry. One cup of the flour (120 g) was mixed with 100 ml of water, pepper ground with onion was mixed with flour and a pinch of salt was added to taste and fried to a golden brown colour on a frying pan for about 3 min.

Pigeon pea moinmoin (pudding): Whole pigeon pea flour was prepared using Fasoyiro *et al* (2006) in which pigeon pea seeds were soaked in warm water for 15 min and then dehulled by hand. The dehulled seeds were then spread on thin aluminium containers and allowed to dry. One cup of flour (120 g) was mixed with 100 ml of water, pepper ground with onion was mixed with flour and a pinch of salt was added to taste. The mixture was packaged in leaves and steamed for about 35 min.

Maize-pigeon pea abari: Fresh maize was ground into paste. Whole pigeon pea flour was prepared using Fasoyiro *et al* (2006) in which pigeon pea seeds were soaked in warm water for 15 min and then dehulled by hand. The dehulled seeds were then spread on thin aluminium containers and allowed to dry. The maize and the pigeon pea flour were mixed at ratio 90:10. Pepper ground with onion was mixed with flour and a pinch of salt was added to taste. The mixture was packaged in leaves and steamed for about 35 min.
Whole and sifted ogi: Whole and sifted maize were demonstrated as described by Fasoyiro *et al* (2013). Plate 1 shows some of the photos of the pigeon-pea based products.

Sensory analysis

*Farmers' consumer acceptability testing***:** Sensory evaluation of the traditional products and snacks were tested by the farmers. Sensory evaluation was carried out to assess the acceptability of the products using the method of Iwe (2002). The product was analyzed for appearance, colour, flavor, texture, taste and overall acceptability by fifteen (15) participants from among the trained farmers. Products were presented as random coded samples. The maize-pigeon pea chinchin, biscuits and cakes were tested with products from whole maize flour respectively. The pigeon pea iru was tested in comparison with the traditionally known iru. Pigeon pea *akara*, pigeon pea *moinmoin* and maize-pigeon pea *abari* were also separately tested without any comparison.

The samples were independently evaluated using a nine-point hedonic scale to determine the preference of each panelist. Ratings were: 1 = "extremely dislike", 2= "dislike very much", 3= "dislike moderately", 4= "dislike slightly", 5= "neither like or dislike", 6= "like slightly", 7= "like moderately", 8= "like very much" and 9 = "extremely like" (Iwe, 2003). The data of the compared samples were statistically assessed by T-test using SPSS version 20. The mean values and standard deviation of the pigeon pea *akara*, pigeon pea *moinmoin* and maize-pigeon pea *abari* were also assessed.

RESULTS AND DISCUSSION

Table 1 shows the farmers' consumer acceptability of the maize-pigeon pea chinchin, biscuit and cake compared with whole maize products. The parameters assessed were appearance, colour, flavor, texture and overall acceptability compared to cassava-pigeon pea products. Whole maize chinchin had higher mean score for appearance, flavour and overall acceptability. Maize-pigeon pea chinchin scored higher for colour while both products were not significantly different at $p<0.05$ for texture and taste. Whole maize chinchin had sensory score within 7.73 to 8.93 while maize pigeon chinchin from 7.00 to 9.33. Whole maize biscuit and maize pigeon pea biscuits were not significantly different at $p<0.05$ for colour, appearance and overall acceptability. Maize-pigeon cake had higher scores for colour, appearance, flavor and taste compared to whole maize cake, while both were not significantly different at $p<0.05$ for texture and overall acceptability. Maize pigeon pea cake had general scores within 7.33 to 7.93 while whole maize cake from 6.8 to7.53.

Table 2 shows the result of acceptability of pigeon pea *iru* compared with the traditional *iru* (African locust bean) among farmers. Traditional iru was not significantly different at $p<0.05$ from pigeon pea iru in colour, appearance and texture. Pigeon pea scored higher for flavor and overall acceptability. General scores for pigeon pea iru were within 7.07 to 8.00 while for traditional iru form 6.64 to 7.79. Previous sensory analysis of pigeon pea dawadawa among other groups showed good acceptability (Fasoyiro *et al,* 2009 and Fasoyiro *et al,* 2009b).

Table 3 shows the sensory scores for pigeon pea akara, pigeon pea moinmoin and pigeon pea *abari* among farmers groups. Sensory scores for various attributes tested were high for all the samples. The sensory score for *akara* ranged within 7.06 to 8.33 for the pigeon pea moinmoin from 7.27 to 8.47 and for the *abari* from 6.80 to 8.40. These values show high acceptability of the products among the farmers.

Locally, pigeon pea is usually consumed as cooked beans eaten with stew among the farmers. However, with research studies, pigeon pea has been processed into various convenience foods for snacks and local diets. Pigeon pea fortified products can be processed into traditional products as breakfast, lunch or dinner meals as well as snacks which will help improve the nutrition of farmers households and at the same time improve pigeon pea utilization. From the evaluation, the farmers at Erin Oke did not only show high acceptability for the products but also the willingness to be planting pigeon pea in the future, requesting also future training on agronomic practices.

Figure 1: showing some of the pigeon pea flour processed products

Table 1: Farmers' acceptability of pigeon pea chinchin, cake and biscuit compared with wheat flour products

Samples	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
Chinchin						
Whole maize flour	8.81b	8.47a	7.73a	8.07a	8.13a	8.93a
maize-pigeon pea flour 90:10	9.33a	7.47b	7.27b	7.13a	7.00a	7.60b
Biscuit						
Whole maize flour	8.07a	8.07a	7.87a	7.37a	7.92a	8.20a
maize-pigeon pea flour 90:10	7.80a	7.33a	6.47a	6.60b	6.20b	7.07a
Cake						
Maizeflour	7.93a	7.73a	7.40a	7.33a	7.47a	7.60a
maize-pigeon pea flour	7.53b	7.27b	7.00b	6.93a	6.80b	7.40a

Mean values of each column with different alphabets is significantly different at $p<0.05$

Table 2: Farmers' sensory acceptability of pigeon pea iru compared with traditional iru

Samples	Colour	Appearance	Flavour	Texture	Overall acceptability
Traditional *iru*	7.79a	7.07a	6.64b	6.79a	7.50b
Pigeon pea *iru*	7.73a	7.33a	7.67a	7.07a	8.00a

Mean values of each column with different alphabets is significantly different at $p<0.05$

Table 3: Mean value of acceptance of pigeon pea akara, moinmoin and abari

Samples	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
Pigeon pea *akara*	8.33± 0.23	7.46±1.64	7.00± 1.36	7.13±1.72	7.06±0.45	7.93±0.31
Pigeon pea *moinmoin*	8.47±0.19	7.80±1.82	7.26±1.66	7.27±1.22	7.33±0.41	8.07±0.26
Pigeon pea *abari*	8.40±0.24	7.30±1.58	6.46±2.03	6.50±2.24	6.86±0.66	7.40±0.55

Mean values in column and standard deviation

CONCLUSION

The consumer sensory evaluation of pigeon pea based products among this farmers community as snacks and local diets showed high acceptability for all the products tested. Request for future training also showed the impact and significance of enlightenment and training programmes through participatory demonstration. There is the need to keep creating the awareness on the nutritional importance of pigeon pea and encouraging the utilization of the pigeon pea products among various communities for improved nutrition, food diversity at tables and for income generation among households. Better utilization of pigeon pea will also increase its production which in turn will increase farmers' income, livelihood and contribute to national food security.

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Cite this Article: Fasoyiro SB; Farinde EO; Oyedokun MO; Adebayo, AK (2019). Dissemination, training on pigeon pea utilization and evaluation of farmers' acceptability of the products at Erin Oke, Osun state, Nigeria. Greener Journal of Agricultural Sciences 9(1): 90-94, http://doi.org/10.15580/GJAS.2019.1.020719026.