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Quality Evaluation of Selected Plantain Varieties (*Musa* species) for Chips and as a Vegetable

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ABSTRACT

The present experiment was conducted to evaluate plantain varieties for chips and vegetable. Five plantain varieties; Cachaca, Saba, Kitawira, Niginu and Kibunga obtained from Jimma University, College of Agriculture and Veterinary Medicine (JUCAVM) were evaluated for their processing (vegetable and chips) and physical quality attributes. To determine the chips quality, the fingers were peeled, sliced to a thickness of 2 mm and deep fat-fried in vegetable frying oil at initial temperature of 180°C for 4 min. Sensory evaluation was conducted for color, taste and crispiness. The result showed that, there were significant differences among the varieties in chips quality except for crispiness. Fruit of Niginu was the biggest of all the other varieties and Kibunga and Kitawira were the varieties with the smallest fruit. Niginu and Kibunga had the best fruit quality for chips processing. Significant differences were obtained for taste as vegetable and non significant differences for appearance as a vegetable. Kibunga and Kitawira showed highly significant differences for chips taste quality.

Key words: Plantain, chips, vegetable, sensory evaluation, frying temperature

INTRODUCTION

Cooking bananas (*Musa* spps.) are an important staple food for many people in pacific. Fruits can be harvested and cooked when still green but some varieties are more commonly used for cooking and they are eaten when still starchy unlike that of desert banana types (Morton, 1987). However, some are also eaten in the half ripe stages in which case they are considered as both "cooking and desert" types. The *Musa* spps. cultivars vary greatly in plant height, fruit size, plant morphology, fruit quality and disease and insect resistance (Morton, 1987).

Most bananas have a sweet flavor when ripe, exceptions to these are cooking bananas and plantains. Bananas are grown in all tropical regions and play a key role in the economies of many developing countries. In terms of gross value of production, banana is the world's fourth most important food crop after wheat and maize (Stover and Simmonds, 1987). Plantains are both a staple food and an export commodity. As a staple, plantains contribute to the food security of millions of people in much of the developing world and when traded in local markets they provide income and employment to rural population (Stover and Simmonds, 1987).

Bananas and plantains are perennial crops that grow quickly and can be harvested all year round. They are high-yielding crops and particularly suited to the farming systems in sub-Saharan agro ecologies (Arias *et al*., 2003). Cooking bananas like desert bananas come in a great variety of shapes, sizes and colors. They may be large, weighing up to 300 g. But some popular types of cooking bananas have small fruit of around 50-100 g. Plantain and banana are important food crops in the humid forest and mid-altitude agro-ecologies of sub-Saharan Africa. They provide more than 25% of the carbohydrates for 70 million people in Africa. In the East African highlands, plantains are the staple food and the region records the highest consumption figures in the world.

Banana fruits are available in plenty in the Tropical countries like India and a large quantity of this fruit is wasted due to poor transportation and storage facilities. Therefore processing and product development using bananas is of utmost importance. Various processed products like figs, clarified juice, banana powder, flour, starch, jam, chips, stem candy and fermented products like ethanol, brandy and beer are prepared and used commonly in India (Voss and Hale, 1998). According to Thompson (1995), processing is recognized as a way of preserving the fruits. Yet the depth of plantain processing is shallow and remained in the small holder producers of West Africa. Apart from this the suitability of the various *Musa* species to the consumers in the world is still in question. New *Musa* species should therefore be evaluated and screened for their processing quality for their wide utilization and marketing. On basis of this, in Ethiopia, banana is the second major fruit crop next to citrus. The dessert type is most popular among the producers and consumers all over the country though the major production takes place in Arbaminch (Southern part of the Country). In spite of the suitable agro ecosystem for banana and so that for plantain in Ethiopia, farmers and consumers lack the culture of processing and value added products. And hence multitude of the population is suffering from post harvest loses and less market value of the fruits.

Therefore, the objective of this study was to evaluate the eating quality and dietary value of five cooking banana varieties.

MATERIALS AND METHODS

Description of the study area: The experiment was conducted at JUCAVM, in the post harvest laboratory. JUCAVM is found in Jimma zone, Kersa woreda of Oromiya regional state. The area is located at south western part of the country 346 km away from the capital city (Addis Ababa).

Experimental materials: Five varieties of plantain were evaluated for their physical, vegetable and chips quality using 8 fingers as a representative from each set of bunches/varieties.

Sampling: Healthy, clean and well matured bunch were selected and 8 representative fingers from middle of the bunch of each variety were collected for chips preparation. Samples from each variety were replicated in to two sets.

Parameters evaluated

Physical parameters: From each set, finger weight, pulp weight, peel weight and the peel to pulp ratio were measured analysis of variance was conducted. For significant results the Least Significant Difference (LSD) and the coefficient of variation (CV %) were determined.

Chips quality evaluation: Fingers from each variety were washed, peeled and sliced to 2 mm thicknesses. The slices were weighed and fried in pre heated frying oil in fryer pan at 180°C for an average of 4 min. And blotted on a tissue paper. Finally, the chips were weighed to find the percent

yield of chips and were evaluated to eating quality using untrained panelists. Panelists of 10 judges were randomly selected from JUCAVM staff and students to evaluate the color, taste and crispiness of the chips on hedonic scale. The same size of duplicate coded samples were presented to judges to work individually and evaluate on pot score from 5 excellent, to 1 inferior rating scale to calculate mean scores of all judges.

Vegetable quality evaluation: Eight representative fingers from the five plantain varieties were collected and were washed, peeled and sliced into 1 cm thicknesses. On an electrically preheated oven first a mix of 2 spoons of chopped onion, garlic and green chilly were cooked and when they showed cooking sign, oil, salt and slice of plantain were added and further cooked for 6 min. Eventually samples were cooled and sensory evaluation was conducted.

Statistical analysis: The raw data was analyzed using analysis of variance (ANOVA). The data was analyzed using SAS software. Fisher's distribution (F-calculated) was calculated. For significant results treatment means were separated using the Least Significant Difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

So far no literature data available to evaluate physical and processing quality parameters of *Musa* species (Cachaca, Saba, Kitawira, Niginu and Kibunga). Results of this experiment show ranges of values that indicate variability among different cooking banana varieties. Most of physical quality evaluation characteristics showed significant difference among varieties.

Physical parameters: The critical examination of data recorded in Table 1 revealed that there were significant differences ($p<0.05$) among different varieties in the physical characteristics of the plantain fruit.

Significant differences ($p<0.05$) were noted among the varieties with regard to finger peel and pulp weight (Table 1). The smallest fruit was Kibunga (91 g) whereas the biggest was Niginu (206 g) followed by Saba (130 g) and Cachaca (106 g) and Kitawira (93 g). Niginu gave a high weight of pulp and peel per fruit followed by Cachaca which indicates that, the larger variety produces the high pulp yield. The smallest variety, Kibunga exceeded Kitawira in its pulp weight due to its smaller peel weight. The pulp to peel ratio is not as high as expected, this is may be due to the higher weight of the cooking banana peel. Akubor and Adejo (2000) looked at the physicochemical, microbiological and sensory changes in stored plantain chips. In their study, they indicated that the pulp component of plantains constituted 62% of the total fruit weight. They further checked the pulp to peel ratio and found a 2:1. The important part of plantain is the pulp

Table 1: Physical characteristic of plantain varieties per fruit

Variety	Mean finger (g)	Mean peel (g)	Mean pulp (g)	Mean pulp to peel ratio
Cachaca	106.90	79.80	85.700	1.08
Saba	129.47	58.17	71.010	1.21
Kitawira	92.97	38.90	53.530	1.38
Niginu	206.20	98.30	106.950	1.01
Kibunga	91.20	31.90	59.010	1.025
LSD (5%)	38.10	19.81	17.695	0.161
CV (%)	14.16	17.19	12.490	6.047

as it can be processed into several edible commodities. Therefore, the higher the pulp to peel ratio means that the economical part is plenty. However in the present experiment the pulp to peel ratio was almost 1:1 in all varieties as can be observed in Table 1. A study by Ogazi (1990), agrees with the findings of Akubor and Adejo (2000) where they demonstrated almost half weight of chips processed from a plantain fruit pulp.

Sensory evaluation and chips yield: The analysis for chips yield and hedonic quality evaluation showed that there were no significant differences ($p>0.05$) among the varieties for chips yield, color and crispiness (Table 2). However, panelists specialized in food processing and chemistry commented that the crispiness of Niginu was the best compared to the others.

In terms of chips color, Cachaka was the best variety (3.70) and Kibunga was the least. In the study carried out by Akubor and Adejo (2000), the maximum chips color was 3.9 recorded during the zero day treatment of the experiment. The same authors have also evaluated the taste and crispiness and taste of chips made from plantain using different time treatments. In their experiment they found that the crispiness of the plantain chips during the first day was 4.0 and was the best quality. The quality of the chips has decreased linearly with time. In our experiment the maximum crispiness value (3.46) was scored by Cachaka variety and the least was (3.04) scored by Saba. The least crispiness value of the chips is associated with leathery, fibrous and high moisture content of the plantain fruit.

Evaluation of the plantain varieties as vegetable food: Around 70 million people in West Africa rely on plantain for their daily food intake. The analysis for hedonic quality evaluation as a vegetable of the five cooking banana varieties showed highly significant difference in taste among the different plantain variety. Kibunga and Niginu showed highest taste then kitawira, Saba and Cachaca (Table 3). High taste as a vegetable is associated with the sweet ingredients in

Table 2: Effect of varieties on chips yield and organoleptic quality of the plantain varieties

		Organoleptic test		
Variety	Chips yield (pulp weight) (g)	Color	Taste	Crispiness
Cachaca	50.6	3.61	2.95	3.46
Saba	45.2	2.94	2.55	3.04
Kitawira	40.08	3.15	2.73	3.08
Niginu	47.4	3.70	3.89	3.70
Kibunga	40.07	2.60	2.78	3.14
LSD (5%)	Ns	Ns	0.52	Ns
CV (%)	6.66	15.5	9.42	9.25

Ns: Non significant

Table 3: Effect of variety on vegetable quality of the five cooking bananas

Variety	Taste	Appearance
Cachaca	0.10	7.43
Saba	0.70	7.37
Kitawira	0.70	7.20
Niginu	1.40	7.40
Kibunga	1.10	7.20
LSD (5%)	0.48	Ns
Cv (%)	24.67	1.96

Ns: Non significant

the pulp. However, there were no significant differences among varieties with respect to appearance. Variation in appearance was narrow among varieties ranging between 7.2 and 7.4 (Table 3). There was significant difference among the varieties with respect to the taste. Niginu was found to be the variety with significantly high taste for vegetable. There was no significant difference among the varieties with respect to appearance (Table 3).

CONCLUSION

The results of the experiment showed that there were significant differences among the verities in fruit quality except for crispiness. In this experiment the fruit of Niginu was the largest in size followed by Saba, Cachaca and Kitawira. With respect to pulp to peel ratio, Kibunga contained twice pulp than peel in weight whereas; Cachaca (1.08) and Niginu (1.1) contained peel to pulp ratio almost in equal amount with pulp. On the basis of some physical and organoleptic fruit characteristics studied in the present experiment Niginu and Kibunga had the best fruit quality for chips processing. Kitawira was the inferior variety for chips processing from its peeling, slicing and bleaching nature. Vegetable and chips quality variability was differentiated best by sensory evaluation which is highly associated with fruit physical and organoleptic parameters. The sensory evaluation of the chips was based on color, taste and appearance. Accordingly, Niginu was found to be the best variety for vegetable processing followed by Kibunga whereas; Cachaka was the least variety as per the evaluation of the panelists.

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