Chemical and Organoleptic Quality of Figs from Selected Sweet bananas (Musa Spp.)

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Abstract

The chemical composition and organoleptic quality of four Cameroonian industrial banana varieties at two ripening stages and figs made from them, were evaluated. The results showed that sucrose content and Lovibond colour index increased significantly with ripening in both fresh fruits and figs and appeared to be the main factors that influenced the appreciation of the quality of the figs. Of the four varieties evaluated for appearance, bitterness, texture, odour and taste, figs from *Gros Michel* were the most appreciated with respect to all the parameters put together.

Introduction

Of about 80,000 tons of dessert bananas produced industrially in Cameroon, just about 58,000 tons are exported and the remainder is supposed to be marketed locally (Fonsah and Chidebelu, 1996; Fogain *et al.*, 1998). In reality, more than half of this amount rots in the plantations due to inadequate local marketing facilities and poor transport infrastructure. The extent of losses of horticultural produce during post-harvest and marketing are widely acknowledged (Wills et al., 1998). Generally, it is estimated that 30% of post-harvest losses of bananas are incurred during wholesale and about 70% during retailing, that is if the actual losses of produce rejected prior to transportation are ignored (Liu and Ma, 1983). In Cameroon, bananas are consumed mostly as dessert. After maturity the fruit can only keep for a few weeks and due to its high moisture content (>70%), marketing over long distances incurs rather high transportation costs. As average incomes are low, populations living out of the production zones can hardly afford the fresh fruits which are a good source of sugar, minerals and vitamins (Eggleston *et al.*, 1992). If consumed in adequate quantities by populations living off the production zones, bananas could significantly improve on the prevailing nutritional imbalances. One way to partly overcome these constraints is to develop new banana products that can be stored for longer and that can be easily transported over long distances at lower costs, the poor infrastructure notwithstanding. Some work is in progress on the development of flours from bananas for the same purpose (Tchango *et al.*, 1998). This paper reports on preliminary studies intended to develop acceptable banana figs for marketing in Cameroon. The objective of this first part is to characterise common sweet banana varieties and determine the chemical and organoleptic qualities of figs prepared from them.

Materials and Methods

Proximate analyses were carried out on fresh bananas and figs of four varieties of *Musa* ssp. grown in Cameroon, notably *Pisang mas*, *FHIA02*, *Gros Michel* and *Yangambi KM5*. The sucrose, ash and volatile matter contents, as well as the Lovibond colour index were evaluated, as a function of the degree of ripening of the fresh banana fruits. The moisture content was estimated as the loss in mass following oven-drying of ~5 g of sample at 105° C till constant weight was attained, and cooling to room temperature over silica gel before weighing. To evaluate the colour, 4 g of a previously dried and ground test portion were dissolved in 10 cm^3 of distilled water and vigorously agitated until a homogeneous mixture was obtained and then decanted through a Whatman No. 1 filter paper. The colour index was recorded after colour-matching the solution with standard colours on a Lovibond 2000 Tintometer. Unbound lipids or free fat was estimated after continuous extraction in diethyl ether and drying in *vacuo*. Since complete extraction is difficult due to high sugar content (Pearson, 1976), each sample was ground with anhydrous sodium sulphate to facilitate extraction. The ash content was estimated by charring at 550 ± 25° C and weighing. To determine the sucrose content, 0.1 g test portion was dissolved in a 99.9 cm^3 mixture of 25% trichloro-acetic acid (TCA) and 0.1% ethylene diamine tetra-acetic acid (EDTA). The mixture was made up to 500 cm^3 with 3 cm^3 of Anthrone reagent and the rest with the TCA. The whole was homogenised. Steam-heated and then cooled to room temperature. The soluble solids were determined from the optical density at 420 nm, using a Labomed Spectrophotometer, with corrections made on the standard curve.

Trained panellists were requested to score sweet banana varieties and figs for general appearance, brittleness, texture, odour, and taste. A scoring scheme ranging from 1-5 was used with 1 being unacceptable and 5 for very good. The two factors studied, ripening stage of the fresh banana and varieties, were treated on a randomised complete block design. Means and coefficients of variations were computed for all quantitative analyses and treatments with homogeneous means ranked using the Newman-Keuls test. Quantitative data were treated in contingency tables and tested for independence using the λ^2 (Chi-square) test. Correlations of treatment factors, chemical characteristics, and organoleptic perceptions were performed separately.

Results and discussion

Composition of Sweet bananas

The mean chemical composition of sweet banana varieties, presented in **Table 1**, indicate that the composition of the fruits varies significantly with its stage of ripening. Whereas no evolution was observed in the moisture content with ripening, the Lovibond colour index and the sucrose content increased by about 30% and 70%, respectively. The ash and lipids content, on the other hand,

Table 1. proximate composition of fresh sweet banana Gros Michel variety *

Ripening stage	Volatile matter (% w/w)	Lovibond colour index	Sucrose (mM/L)	Lipids content (%w/w)	Ash (%w/w)
Unripe (green)	74.1 ± 0.15	9.0 ± 0.2	10.8 ± 0.52	4.21 ± 0.15	4.32 ± 0.18
Ripe (yellow)	74.0 ± 0.22	12.0 ± 0.6	18.2 ± 0.21	3.67 ± 0.18	3.10 ± 0.22
Variance from unripe (%)	-1	+33	+68	-13	-28

*Values are expressed as an average and a standard deviation of ten sample measurements

Table 2. Effects of the degree of ripening on the composition of banana figs*

Ripening stage	Variety	Sucrose mM/L	Ash (%w/w)	Volatile matter (%w/w)	Lovibond colour index
Average	*Pisang mas*	23.4 ± 0.66^{A}	2.19 ± 0.25^{B}	21.8 ± 0.51^{B}	9 ± 0.0^{B}
	FHIA 02	$6.7 \pm 0.0.40^{C}$	3.17 ± 0.26^{A}	25.7 ± 0.16^{A}	13 ± 0.6^{A}
	Gros Michel	10.5 ± 0.06^{B}	2.88 ± 0.19^{A}	15.8 ± 0.17^{C}	14 ± 0.0^{A}
	Yangambi KM5	18.7 ± 0^{B}	3.16 ± 0.08^{A}	22.1 ± 0.17^{B}	14 ± 0.0^{A}
Advanced	*Pisang mas*	31.2 ± 0.96^{A}	2.39 ± 0.18^{B}	22.0 ± 0.53^{B}	10 ± 0.0^{B}
	FHIA 02	19.0 ± 0.51^{B}	3.29 ± 0.28^{A}	25.9 ± 0.05^{A}	13 ± 0.6^{A}
	Gros Michel	20.7 ± 0.47^{B}	3.01 ± 0.23^{A}	15.8 ± 0.12^{C}	14 ± 0.0^{A}
	Yangambi KM5	19.1 ± 0.00^{B}	3.28 ± 0.12^{A}	22.3 ± 0.25^{B}	15 ± 0.6^{A}

*Values are expressed as an average and standard deviation of three sample measurements.

Properties of varieties followed by the same letter for a given stage of ripening were not significantly different at P =5% (Newman-Kleus test).

decreased by about 28% and 13% with ripening of the banana fruits. The starch content of unripe bananas is progressively converted to sugars in the ripe bananas, between limits of 80 and 12% from the unripe to the ripe fruits while that of the total sugars vary with the same magnitude but in the reverse order on ripening (Eggleston *et al.*, 1992).

Table 2 shows the effect of the degree of ripening on the composition of figs prepared from the four varieties. They clearly show that the composition of the figs varied with the degree of ripening of the fresh fruits and the botanical variety used. Unlike the ash content, the moisture and the Lovibond index which did not vary on extending the ripening of the fresh fruits from average to advanced, the sucrose content of the figs increased significantly. The *Pisang mas* variety at average ripening had the highest sucrose content followed by *Yangambi KM5*, *Gros Michel* and *FHIA02*, in decreasing order. Whereas *Pisang mas* still had the highest sucrose content at advanced ripening (31.2 mM/L), the rest of the varieties had almost the same content (~19.0 to 20.7 mM/L). Of the four varieties tested, *Pisang mas* figs had the lowest ash content irrespective of the extent of ripening of the fresh fruits. This variety was therefore always classified differently from the others. The *FHIA02* variety, unlike *Gros Michel* had a greater tendency to retain more moisture during drying. This could probably be due to the physical structure as the more spongy nature of *Gros Michel* makes it more prone to losing moisture during the drying operations. The Pisang mas variety had the clearest figs (low colour index) as compared to the other varieties.

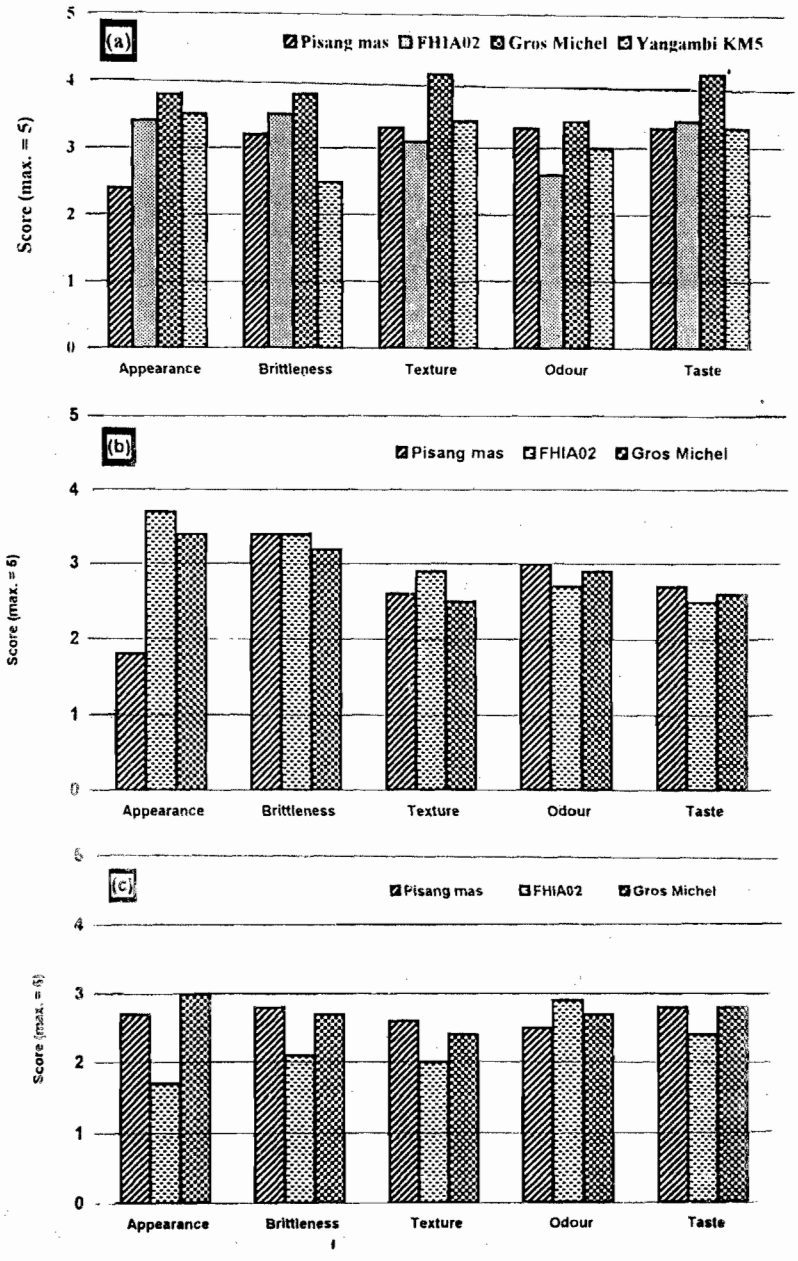
The results of the organoleptic assessment of the fresh banana fruits and figs showed that the perception of the quality of the figs varied rather significantly with the banana variety used. The results for the fresh fruits, depicted in **Fig. 1 (a)**, show that the appearance of the fresh fruits of *Pisang mas* was most appreciated, *Gros Michel* was the most brittle and *FHIA02* was most appreciated in terms of texture and odour. On the other hand, *Yangambi KM5* was the least appreciated in terms of its appearance, brittleness, texture and taste, *Pisang mas* and *Gros Michel* were generally appreciated as of similar texture and taste while *FHIA02* and *Gros Michel* were of similar appearance and taste.

The results of the sensory evaluation of figs made from moderately ripe and over-ripe banana fruits, are presented in **Fig 1(b)** and **Fig 1(c)**, respectively. Considering the poor keeping quality and the poor appreciation of the fruits of *Yangambi KM5*, this variety was not included in this series of tests.

Of the figs obtained from moderately ripe fruits, *Pisang mas* was most appreciated in terms of its appearance but its taste, texture, brittleness and especially odour were rated as poor **(Fig 1b)**. *Gros Michel* apparently was the compromise of the other varieties with respect to all the attributes evaluated. The appreciation of the quality of figs from over-ripe fruits did not seem to differ much with that obtained on the moderately ripe fruits. However, the appearance of the over-ripe *Gros Michel* figs was rated poor while the *Pisang mas* was least appreciated with respect to its brittleness and texture.

In conclusion, the sucrose content and Lovibond colour index of the bananas increased on further ripening and subsequently influenced the quality of

Fig 1. Effect of the extent of ripening on the organoleptic characterisation of sweet banana varieties. (a) - ripe and fresh sweet bananas; (b) - moderately ripe sweet banana figs; (c) - over ripe sweet banana figs.



the figs made from them. Hence, the quality of the figs varied with the extent of ripening. Of the four varieties evaluated *Gros Michel* appeared to be the most suitable variety for the production of figs taking into consideration all the parameters evaluated. Further studies are needed to confirm these results with consumer surveys.

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