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# FARMER EVALUATION OF DRIED BANANA-BASED PRODUCTS

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## ABSTRACT

A farmer participatory evaluation of dried banana based products was conducted in various districts of Uganda. Bananas were dried using a tunnel solar dryer developed by Post Harvest Handling and Storage project (PHHS) of Kawanda Post-harvest Programme and improved by the National Banana Research Programme. The dried banana was milled into flour using a high speed rotary mill. Porridge and thick-porridge (*ugali*) were prepared using 100% banana flour, a mixture of banana-millet flour in the ratios of 8:2 and 9:1, and banana-millet-soybean in the ratio 7:2:1, banana-millet-soybean- maize in the ratio of 7:1:1:1 and banana-millet-cassava in the ratio of 7:2:1. Acceptability of the products was tested by farmers and scored on a hedonic scale. Statistical analysis showed the mixture of banana-millet-soy in ratio of 7:2:1 and that of banana-millet in a ratio of 8:2 were best for porridge and thick porridge *(ugali)*, respectively.

*Key Words*: Acceptability, farmer participatory, hedonic scale, *Musa* spp.

## RÉSUMÉ

Une évaluation participative des fermiers des produits secs dérivés de la banane était conduite dans plusieurs districts de l'Ouganda. Les banana étaient séchées en utilisant un séchoir solaire en forme de tunnel développé par le projet Post Harvest Handling and Storage (PHHS) de Kawanda Post-Harvest Programme et amélioré par le National Banana Programme. Les bananes séchées étaient transformées en poudre en utilisant un moulin du type rotary à grande vitesse. La bouillie et le foufou étaient préparés sur base de la banane (100%), du mélange banane et millet a un taux de 8:2 et 9:1, et banane-millet-soya à un taux de 7:2:1, banane-millet-soya-maïs a un taux de 7:2:1. L'acceptabilité des produits était testée par les fermiers et marquée sur une échelle hédonique. L'analyse statistique montre que le mélange banane-millet-soya au taux de 7:2:1 et celui de la banane-millet au taux de 8:2 étaient les meilleurs pour la bouillie et *l'ugali*, respectivement.

*Mots Clés*: Acceptabilité, participation des fermiers, echelle hédonique, *Mus*a spp.

## INTRODUCTION

Banana is one of the most important crops in Uganda. Area under banana cultivation is 1.3 million ha, equivalent to 33% of all cropped land. Annual banana production is over 9 million tons per year (Tushemereirwe *et al.*, 2001). Most of the bananas produced in Uganda are consumed locally with only a few being exported to Western European markets (IDEA, 1998). Locally, major banana markets are in urban centers. The bananas are transported from rural areas to the urban consumers as bunches on trucks or bicycles. This form of marketing bananas has a number of disadvantages. The farmer makes losses because some bunches are small, considered below market size and hence not saleable. Transportation of banana is costly, leaving the traders with a small margin, which they attempt to increase by paying as less as possible to farmers. Mugisha (1994)

reported that transportation costs of delivering bananas to the major consumer markets in Uganda (Kampala, Entebbe, Jinja) accounted for about 90% of the total marketing costs and about 30% of the whole sale price; consequently, farm prices were low, consumer prices high and traders' returns were very low. This was mainly attributed to, among other factors, the bulkiness of bananas. The other disadvantage with the current marketing system is that banana is transported whole with unwanted parts (peels and stalks which account for about 30% of the whole bunch). This poses waste disposal problems in the urban areas. On the other hand, this leaves the soils on farm depleted of nutrients. The above scenario necessitates developing a technology that reduces the bulkiness of bananas, extends the shelf life, makes use of under size bunches, widens utilisation and converts the banana into a convenient food item (easy to transport and prepare). Further, such a technology will not deplete the farms of soil nutrients, one of the major factors limiting banana production in most areas in Uganda, as wastes will be recycled or used as animal feed on farm.

Drying, is one of the oldest techniques for preserving agricultural products. In Uganda, farmers reported that 'Mbidde' (AAA-EA), traditional juice bananas, are usually dried and preserved for use in periods of famine (National Banana Research Programme, 2002). Drying reduces moisture content and prevents the growth of micro-organisms responsible for the decay of food. The bananas could thereafter be transformed into shelf stable primary and secondary products. This will widen markets and increase income for farmers from bananas.

The challenges involved in processing foods have always been the need to balance inputs, final product costs and quality changes caused by the process that may negatively affect acceptability. Indeed the problems in the utilisation of dried bananas are changes in taste and the prominence of the sharp banana flavour in consequent products. The focus of this study was to reduce these problems by adding other commonly available products such as millet, cassava and soybean flours. In addition to modifying taste and flavour, the composites also improve the nutritional value of the product. This paper reports results of farmer participatory evaluation of two common products, porridge and thick-porridge (*ugali*), made from banana based composite flours.

## MATERIALS AND METHODS

Bananas (FHIA 17, FHIA 25, FHIA 1, PITA 16, KM5, SABA, and AAA-EA cooking banana) were harvested when the angularity of the fingers was approximately full (Thompson and Burden, 1995) an indication of full physiological maturity. They were manually peeled using knives, washed in cold water and sliced longitudinally using a Super Slicer TM. Slices were spread on plastic–mesh trays and dried in an improved tunnel solar dryer, PHHS (Fig. 1) until a crack sound could be heard on breaking. Dried chips were packaged in polythene bags and kept in a clean dry store pending use.

The dried banana chips were milled into flour using a high speed rotary mill. Porridge and thick-porridge (*ugali*) were prepared using 100% banana flour, a mixture of banana and millet flour in the ratio of 8:2 and 9:1, banana, millet, soy bean and maize flour in ratio of 7:1:1:1 and banana-millet-soy in the ratio of 7:2:1 respectively. The flour was packaged in polythene bags (Fig. 2), labeled and sealed with an impulse heat sealer.

Porridge and thick-porridge were prepared in saucepans by farmers to the consistency of their preference. Samples were served on plates and/or cups. To porridge, sugar was added and thick-porridge was served with cooked beans. The products were tested and results were recorded on a hedonic scale of 1-5, extreme dislike-extreme liking (Fliedner and Wilhelmi, 1989) after translation in one of the local languages. Porridge and thick-porridge are the commonly prepared products from flours in Uganda. The main participants in the sensory evaluation were farmers from Kawempe-Kampala, Kisekka-Masaka, Kamuli-Nawanyago and Kagoma-Jinja.Data was subjected Analysis of Variance (ANOVA) procedure in Statistical Analysis Systems (SAS) (Anon., 1990). Significant means were separated to assess signifcant differences.

## RESULTS AND DISCUSSIONS

Farmers complained of high astringency in products made using flour from FHIA 25, PITA 16 and KM5. These were dropped in the subsequent tests. Cultivars FHIA 25 and KM5 are best used for making juice and it is well known that traditional juice cultivars are highly astringent. However, flour from the rest of the cultivars was equally acceptable and so was not differentiated in these tests.

Overall acceptability of porridge and thick-porridge (*ugali*) from pure banana flour was significantly ($P<0.05$) lower than that from banana composite flour. Porridge from pure banana flour scored significantly ($P<0.05$) lower in taste, mouth

Figure 1. Improved PHHS tunnel solar dryer.

Figure 2. Packed banana flour.

feel and colour than that from maize and soybean flour (Table 1). It was however, not significantly (P>0.05) different in flavour. The taste, mouth feel and colour affected overall acceptability. Porridge from pure banana flour was significantly less acceptable compared to that of maize, soybean and millet flour, which is popularly used for making porridge.

Incorporation of popularly used flours to banana flour significantly (P<0.05) improved the attributes of mouth feel, taste, colour, flavour and overall acceptability (Table 2). The best liked combination was that with banana-millet-soy in the ratio of 7:2:1 .

Thick-porridge is commonly made from pure maize flour, pure cassava or a mixture of cassava and millet flour. Thick-porridge from pure banana flour was significantly (P<0.05) less liked than that from maize and cassava in terms of mouth feel, taste, colour and therefore overall quality (Table 3). Its flavour, however, was liked almost as much (P>0.05) as that of thick-porridge from the other flours.

Just like in the case of porridge, inclusion of commonly used flours in banana flour improved the appeal for thick-porridge made from banana flour significantly (P>0.05).

Overall acceptability of banana with millet flour

TABLE 1. Means of sensory evaluation scores for porridge from pure flours

| Product | Mouth feel | Taste | Colour | Flavour | Acceptability |
|---|---|---|---|---|---|
| Banana | 3.2 cd* | 2.6 c | 3.7 b | 3.3 a | 2.8 b |
| Maize | 4.5 ab | 4.3 ab | 4.5 a | 4.3 a | 4.6 a |
| Cassava | 4.9 a | 4.9 a | 4.6 a | 4.1 a | 4.1 a |
| Soy | 2.8 d | 2.8 c | 2.8 c | 3.5 a | 2.5 b |
| Millet | 3.9 bc | 3.7 b | 4.1 ab | 3.8 a | 3.9 a |

*Within colums means followed by the same letter are not significantly different (P≤ 0.05)

TABLE 2. Means of sensory evaluation scores for porridge from composite flours

| Product | Mouth feel | Taste | Colour | Flavour | Acceptability |
|---|---|---|---|---|---|
| Banana | 3.3 b* | 2.7 c | 3.3 a | 3.1 b | 2.7 b |
| Banana-Millet (8:2) | 3.7 a | 3.3 bc | 3.7 a | 4.0 a | 3.7 a |
| Banana-Millet-Soy (7:2:1) | 4.5 a | 4.5 a | 4.2 a | 4.1 a | 4.5 a |
| Banana-Millet (9:1) | 3.8 a | 4.3 a | 3.8 a | 3.6 a | 3.6 ab |
| Banana-Millet-Soy-Maize (7:1:1:1) | 4.3 a | 4.1 a | 3.6 a | 4.2 a | 4.0 a |
| Banana-Millet-Cassava (7:2:1) | 3.9 a | 3.6 ab | 3.7 a | 3.7 a | 3.8 a |

*Within colums means followed by the same letter are not significantly different (P≤ 0.05)

TABLE 3. Means of sensory evaluation scores for thick-porridge (*Ugali*) from pure flours

| Product | Mouth feel | Taste | Colour | Flavour | Acceptability |
|---|---|---|---|---|---|
| Banana | 3.2 cd | 2.6 c | 3.7 b | 3.2 a | 2.8 b |
| Maize | 4.5 ab | 4.3 ab | 4.5 a | 4.3 a | 4.6 a |
| Cassava | 4.9 a | 4.9 a | 4.6 a | 4.1 a | 4.1 a |
| Soy | 2.8 d | 2.8 c | 2.8 c | 3.5 a | 2.5 b |
| Millet | 3.9 bc | 3.7 b | 4.1 ab | 3.8 a | 3.9 a |

*Within colums means followed by the same letter are not significantly different (P≤ 0.05)

TABLE 4. Means of sensory evaluation scores for thick-porridge (*Ugali*) from composites

| Product | Mouth feel | Taste | Colour | Flavour | Acceptability |
|---|---|---|---|---|---|
| Banana | 3.2 c | 2.6 b | 3.7 ab | 3.3 c | 2.8 c |
| Banana-Millet (8:2) | 4.2 a | 4.1 a | 4.2 a | 4.1 ab | 4.3 a |
| Banana-Millet (9:1) | 3.9 ab | 4.0 a | 4.0 a | 4.1 a | 3.9 ab |
| Banana-Millet-Soy-Maize (7:1:1:1) | 3.7 abc | 3.7 a | 3.6 ab | 3.5 bc | 3.6 b |
| Banana-Millet-Soy (7:2:1) | 3.4 bc | 2.9 b | 3.5 ab | 3.4 c | 2.8 c |
| Banana-Millet-Cassava (7:2:1) | 3.3 bc | 3.6 a | 3.3 b | 3.2 c | 3.5 b |

*Within colums means followed by the same letter are not significantly different ($P \leq 0.05$)

in the ratio of 8:2 was the highest. Generally, all the considered attributes namely, mouth feel, taste, colour favour and acceptability were scored higher in thick-porridge from composite flours than that from pure banana flour.

## CONCLUSIONS AND RECOMMENDATIONS

Inclusion of the popularly used flours for porridge into banana flour greatly improves the acceptability of banana flour products. Porridge made using a combination of banana-millet-soybean flour in the ratio of 7:2:1 was the most acceptable. On the other hand, thick-porridge(*ugali*) made using banana-millet flour in the ratio of 8:2 was the most aceeptable. The combinations of banana flour with soybean flour was liked in porridge but not in thick-porridge (*ugali*). Traditionally soybean flour is used in either porridge or sauce making.

It is recommended that the flour combinations be further worked on to improve acceptability and nutrition. Incorporation of banana flour in food formulae for infants and invalids is highly recommended due to easy digestibility of the banana starch (INIBAP, 2001).

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