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Effects of Pre-Treatment on the Proximate Composition and Functional Properties of Plantain (*Musa Parasidica*) Flour.

Ajayi Adebola

Department of Food Technology, Federal Polytechnic, Ilaro, Ogun State Nigeria.

A B S T R A C T

The proximate composition and functional properties of pre-treated plantain (*Musa parasidica*) flour were determined. The determination were done using standard methods. The plantain flour was produced using different pre-treatments: the use of sodium meabisulphites, blanching at 80^0C for 10min, unblanched, and combination of blanching and sodium metabisulphite treatment. The results of the proximate composition calculated on dry weight basis showed that the moisture contents for the various pre treatment ranged from 10.10±0.01% to 12.10±0.04% Ash content ranged from 1.91±0.01% to 3.8±0.07%, Fat ranged from 2.42±0.03% to 3.75±0.05%, Protein content ranged from 5.51±0.03 to 8.10±0.03%, Fibre values ranged form 74±0.01% to 78±0.05%. The functional properties showed significant difference (P≤0.05) the various pretreatment.

Keywords: Plantain flour, Pre-Treatment, Proximate Composition, Functional Properties

1. Introduction

Plantain (*musaspp*) is an important staple crop that contributes to the calories and subsistence economies in Africa. They are good sources of carbohydrate (Marriott et al.,1981 ;Adeniyi, et al 2006)reported that 100g edible portion of plantain contains 67.30g moisture, 0.4g crude fat, 31.15g carbohydrate, 0.95mg potassium, 35.1mg sodium, 71.5mg calcium, 28mg phosphorus, 2.4mg iron and yielded 116kcal of energy. Nearly all edible plantain cultivars are derived from two wild species, *Musa acuminate* and *Musa balbisiancea*(Oladele, andAina, 2007).

In Nigeria, the green and ripe plantain fruits are either eaten boiled, roasted, baked or fried. It may also be dried form later use in cooling or ground for use as a meal, which can be further refined to flour about 80% of the harvested plantain is obtained during the period of September to February and there is much waste of this crop during the peak period. Store for a long period, resulting in seasonal availability and limitation of use (Ogazi1996). In order to extend the shelf-life of plantain, it can be pre-treatment and dried. Drying is a method normally used to preserve plantain in order to make it available all year round.

Pretreatment of food samples as a procedure usually carried out prior drying or dehydrate of the sample. The foods to be dried must be washed, peeled, cut and precooked. Plantain is pretreated for the reduction of enzymic browning during processing. Pretreatment can be done by blanching, addition of salt, meta-bisulphite treatment and other. The pretreatment helps plantain to keep its natural colour and reduces oxidation and vitamins loss. Food drying is the process of removing water form food, thus inhibiting the growth of microorganisms and enzymes by circulation of hot, dry air through the food. It was highlighted that food drying can be used to preserve some perishable agricultural produce, for their availability. All year round reduce post harvest loses and achieve food security (Agoreyo 2011).

The common drying methods in Nigeria are sun, cabinet and solar drying. Drying of plantain is aimed at getting reconstitutable plantain flour to form paste or dough. Plantain flour may be reconstituted in boiling water to make “amala” and eaten with vegetable soup, it can also be used to prepare plantain cake or in making bread.

This study was done to determine the effect of pretreatment on the proximate composition and functional properties of plantain (*Musa parasidiaca*) flour

* *Corresponding author.*
E-mail address: wonderfullink@rocketmail.com

2. Materials and Method

Matured green plantains fruits (*Musa parasidiaca*) were obtained from Sayedero market, Ilaro, Yewa South, Ogun State, Nigeria. All other materials and chemicals were of analytical grades and were gotten from Food Technology Department, Federal Polytechnic, Ilaro.

2.1.1 Preparation of Plantain Flour

The matured green plantain fruits bunch was cut into individual fruits and was defingered and weighed. The plantain was washed, peeled and cut approximately (2mm thick) using the stainless steel knife. Sodium metabisulphite ($Na_2S_2O_5$) 2.0% was prepared by dissolving 2g of the salt approximately 100ml of distilled water, plantain slices were poured inside the 25ml of prepared 2.0% sodium metabisulphite. The suphited pulp was then dried in the oven dryer at 60^0C for 24hours to obtain dry chip. The dried chips were milled using the milling machine.

3. Analysis

3.1 Functional Properties -

The following functional properties were studied were; bulk density, water absorption capacity, solubility, swelling power and dispersibity

3.1.1. Water Absorption Capacity

Water and oil absorption capacities of the flour samples were determined as described by (Abbeysward 1988) with slight modification. One gram of flour sample mixed with 10ml of distilled water or oil was placed in a centrifuge tube. The suspension was agitated for one hour on a griffin flask shaker after which it was centrifuged for 15 min at 2200 rpm. The volume of water or oil on the sediment water was measured. Water and oil absorption capacities were calculated as ml of water or oil absorbed per gram of flour respectively.

3.1.2 Swelling Power and Solubility

This was determined by the method described by (Oladele andAina2007). One gram of the flour was mixed with 10 ml distilled water in a centrifuge tube and heated at 80 ^{0}Cfor 30 minutes. This was continuously shaken during the heating period. The tube was removed from the bath, wiped dry, cooled to room temperature (28 ^{0}C) and centrifuged for 15 mins at 2200 rpm. The supernatant was evaporated, and the dried residue weighed to determine the solubility. The swollen sample (paste) obtained from decanting supernatant was also weighed to determine the swelling power. Swelling power was calculated as weight of the paste/weight of dry sample.

3.1.3 Bulk Density

This was determined by the method of (Wang, 1976). A known amount of sample was weighed into 50ml graduated measuring cylinder. The sample was packed by gently tapping the cylinder on the bench top from a height of 5cm. The volume of the sample was recorded

$$\text{Bulk density} = \frac{\text{Weight of Sample g/ml or g/cm}^3}{\text{Volume of Sample after tapping}}$$

3.1.4 Dispersibility

This was determined by the method described by (Kulkarni, 1983). 10g of flour was suspended in 100ml measuring cylinder and distilled water was added to reach a volume of 100ml. The set up was stirred vigorously and allow settling for 3 hours. The volume of settled particles was recorded and subtracted from 100. The difference was reported as percentage dispersibility.

3.2 Proximate Analysis

3.2.1 Moisture Content Determination

The moisture content of the sample was determined using standard method according to (AOAC 2000).
Two (2) grams of each of the samples was weighed out with an analytical balance into dried, cooled and weighed dish in each case. The samples in the oC dishes were then put into a moisture extraction oven set at 105 and allowed to dry for 3 hours when this time elapsed, the samples were then transferred into a dessicator with a laboratory troy and then allowed to cool for about 20 minutes. They were thereafter weighed again and their respective weights recorded accordingly. These processes were repeated for each sample until a constant weight was obtained in each case. The difference weight was calculated as a percentage a of the original sample.

$$\% \text{ Moisture} = \frac{\text{loss in weight due to drying}}{\text{Weight of sample taken}} \times \frac{100}{1}$$

$$= \frac{W2 - W3}{W2 - W1} \times \frac{100}{1}$$

$$\text{Moisture (\%)} = \frac{\text{Initial weight (g) final weight (g)}}{\text{Sample weight (g)}} \times \frac{100}{1}$$

3.2.2 Crude Protein Determination

Protein is the major compound containing Nitrogen. Nitrogen is used as an index of the protein termed 'Crude Protein' as distinct from true protein (AOAC 2000).Kjeldahl method is the most reliable for insoluble food stuff.

Half a gram (0.5g) of each of the samples was mixed with 10ml of concentrated H_2SO4 acid in a Kjeldahl digestion flask. A tablet of the selenium catalyst was added to each of the samples which were then digested (heated) inside a fume cupboard until a clear solution was obtained in a separate flask in each case. Also, a blank was made by digesting the above reagents without any sample in it. Then, all the digests were carefully transferred into a 100ml volumetric flask in each case and were made up with distilled water. A 100ml portion of each digest was mixed with equal volume of 45%nNaOH solutions in a Kjeldahl distilling unit. The resulted mixtures were each distilled and the distillates collected in each case into 10ml of 4% boric acid solution containing three drops of mixed indicators (bromocresol green and methyl red). A total of 50ml of each distillate was obtained and titrated with 0.02 molar H_2SO4 solutions. Titration was done from the initial green color to a deep red end-point. The nitrogen contents of each sample were calculated thus; (AOAC 2000).

$$\% \text{ Nitrogen} = \frac{\text{Volume of acid Hcl used X 0.0014 X 100 X 100}}{\text{Weight of sample} \quad 1 \quad 1}$$

Note: 1ml of 0.1ml Hcl= 0.0014gN

Crude Protein = % Nitrogen x 6.25%

3.2.4 Crude Fat Determination

Two hundred and fifty milliliters of boiling flasks were washed with water, dried in an oven set at 105ºc for 25minutes, cooled in a desiccator and then used for each sample. The flasks were firstly labeled, weighed with a weighing balance and then filled with 200ml of petroleum ether in each case. Then, five grams of each of the samples was weighed out into a correspondingly labeled thimble. The extraction thimbles were in each case tightly plugged with cotton wool. The soxchlet apparatus was then assembled and allowed to reflux for 6 hours. Thereafter, the thimble was removed and the petroleum either was collected in each case in the top of the container in the set up and drained into another container for re-use. The flasks were then removed in each case and dried in an oven at 105ºc for 1hour. After drying, they were placed in a desiccator where they cooled for about 20minutes and thereafter weighed. The percentage fat content was calculated for each sample thus: (AOAC 2000).

$$\text{Crude fat (\%)} = \frac{\text{initial weight(g)- weight after extraction(g)}}{\text{Sample weight (g)}} \times \frac{100}{1}$$

3.2.5 Ash Content Determination

Two (2) grams of each of the samples was weighed out using an analytical balance into a dried, cooled and weighed crucible in each case. The samples were then charred by placing them on a Bunsen flame inside a fume cupboard to drive off most of the smoke for 30minutes. The samples were then transferred into a pre- heated furnace at 550ºC with a laboratory tong. They were allowed to stay in the furnace for 3 hours until a white or light grey ash resulted. Samples that remained black or dark in color after this time had elapsed were moisture with small amount of water to dissolve salts, dried in an oven and then the ashing processes repeated again. After ashing, the crucibles were then transferred into a desiccator with a laboratory tong after cooling they were each weighed again and recorded accordingly (AOAC 2000).

$$\text{ASH (\%)} = \frac{\text{Weight of crucible with ash(g)}}{\text{Weight of crucible with sample (g)}} \times \frac{100}{1}$$

3.2.6 Crude Fibre Determination

Five grains (5g) of each of the samples were used in this determination. The samples were each boiled in 500ml flask containing 200ml of 1.25% *H2SO4* solution under reflux for 30minutes. When this time elapsed, the samples were washed with several portions of hot boiling water using a two-fold muslin cloth to trap the residual particles. The residual particles in each case were carefully transferred qualitatively back to the flasks and 200ml of 1.25% NaOH solution was then added into each flask. Again, the samples were boiled for 30minutes and washed as before with hot water. Then, they were each

carefully transferred into a weighed crucible and then dried in an oven set at 105ºc for 3 hours. The dried samples were then put into desiccator where they cooled for about 20 minutes before being weighed again. They were then put into a muffle furnance set at 550ºC for 2 hours (until ashed).
Finally, they were cooled in desiccator and weighed again. The crude fiber content for each sample was calculated thus (AOAC 2000).

$$\text{Crude fibre}(\%) = \frac{\text{weight residue with crucible(g)} - \text{wtofash with crucible x } \frac{100}{1}}{\text{Weight of fat free sample (g)}}$$

3.2.7. Carbohydrate Content Determination

The carbohydrate content was calculated by deducting the sum of the values for moisture, crude protein, crude fat, crude fibre and Ash in 100 (AOAC 2000).

4. Results

Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 9.5 pt. Here follows further instructions for authors.

Table 1: Proximate composition of pretreated plantain flour

Samples	Ash (%)	Moisture (%)	Fat (%)	Protein (%)	Fibre (%)	Carbohydrate (%)
UPF	3.80±0.07	12.10±0.04	2.42±0.03	5.15±0.03	2.09±0.08	78.1±0.05
BPF	1.97±0.03	11.44±0.21	2.42±0.06	5.62±0.01	1.12±0.03	77.4±0.01
BMF	1.91±0.01	11.13±0.10	3.82±0.04	7.45±0.11	1.10±0.03	74.64±0.01
SMF	2.05±0.09	10.10±0.01	3.75±0.05	8.10±0.03	1.25±0.01	80.80±0.09

Values were mean ± standard deviations of triplicate determinations

Table 2: Functional Properties of Pre-Treated Plantain Flour

Samples	Bulk Density (G/Ml)	Swelling Power (%)	Solubility (%)	Water Absorption (%)
UPF	0.77±0.09	48.89±0.04	5.57±0.01	220.00±0.05
BPF	0.67±0.05	39.49±0.01	6.47±0.21	310.00±0.01
BMF	0.71±0.11	35.82±0.02	5.90±0.06	320.00±0.04
SMF	0.77±0.01	38.18±0.04	6.80±0.03	340.00±0.01

Values were mean ± standard deviations of triplicate determinations.
UPF: Unblanched plantain flour
BPF: Blanched plantain flour
BMF: Blanched and sodium metabisulphite flour
SMF: Sodium metabisulphite flour.

5. Discussion

The result of the effect of pretreatment on the proximate analysis of the plantain flour is represented on the Table 1. The result showed significant difference on the proximate composition of the pretreatment plantain flours. The unblanched plantain flour which also serves as a control has 3.8% ash. This is higher than the value reported by (Ketiku 1973). The blanched and sodium metabsulphite treated flour has the least ash content which is between the range of 1.66 – 2.00%) value reported by (Ketiku 1973). The moisture content value of unbalanced plantain flour is greater than that of the other flour. It is within the range of value quoted in literature (USDA 2003).This is probably because it is not subjected to any form of pretreatment which tends to speed up the rate of drying of food samples. Blanched plantain flour has a moisture content of 11.44% while blanched and sodium metabisulphite flour has a moisture content of 11.13%. Sodium metabidulphite treated flour has the moisture content of 10.10%. This indicate that sodium metabisulphite treated flour has a longer shelf life than other pretreated plantain flours because of its low moisture content which makes it difficult for micro-organisms to thrive, hence causing spoilage. The percentage fat of the flours is different with unblanched plantain flour having the least fat content of 0.42%. This is lesser than he value reported by (Fagbemi, 1999). Sodium metabisulphite flour having the highest fat content of 8.75% from the result of the analysis, the

fat content of the flour tends to gradually increase as the intensity of the pretreatment progress. The high fat content of the flour makes the flour to be subjected to rancidity. The protein content of the flour varies from one another. The unblanched plantain flour has the lowest protein content of 5.15% and the sodium metabisulphite plantain flour has the highest protein content of 8.10% (Fagbemi, 1999).reported the protein content of unblanched plantain flour to be 3.6%. This is lower than the value reported in this work. The high fat content of other flours may be the effect of pretreatment methods to which the plantain was subjected.

Unblanched plantain flour has the highest crude fibre content of 2.09%. Blanched and Sodium metabisulphite flour has the lowest crude fibre content of 1.10% and the sodium metabisulphite flour has 1.25% of crude fibre. (Izonfuo and Omuaru1988).reported the crude fibre content of unblanched plantain flour to be 0.9% which is lesser than the value reported in this work. The pretreatments applied to the plantain tends to decrease the fibre content of the flour respectively. The percentage carbohydrates content of the flour gradually induced. Unblanched plantain flour has carbohydratecontnt of 78.1%. The blanched plantain flour has 77.4% carbohydrate. Blanched and sodium metabisulpnite flour has 74.64% carbohydrate and sodium metabisulphite flour has the highest content of 80.80% carbohydrate. The high carbohydrate in the raw mature green plantain use to process the flour. However, there seems to be a decrease in the carbohydrate content of the pretreated flours.

The functional of the flour also vary with respect to pretreatment given to each of the flours. Unblached plantain flour has bulk density of 0.77g/ml. The bulk density of unblanched plantain flour and sodium metabisulphite flour is the same. Blanched plantain flour has the lowest bulk density of 0.67g/ml and blanched and sodium metabisulphite flour has 0.71g/ml. the swelling power of the flour varies with unblanched plantain flour having 35.82% swelling power. The unblanched plantain flour has the highest swelling power and blanched and sodium metabisulphite flour has the lowest swelling power. The solubility of the flour varies with metabisulphite flour having the least solubility percentage of 5.57% and sodium metabisulphite flour having the highest soulubility value. The sodium metabisulphie pretreatment increased the solubility of the plantain flour. The water absorption capacity of the flour varies with unblanched plantain flour having 220%. The blanched plantain flour has 319% water absorption capacity. Blanched metabbisulphite flour has 320% capacity and sodium metabisulphite flour hast the highest water absorption capacity of 340%. The higher water absorption capacity of the sodium metabisulphite flour may be due to the low moisture content of the flour which is as a result of the pretreatment used.

6. Conclusion

The plantain flour treated with different pretreament shows difference in their proximate analysis. The sodium metabisulphite treated flour has the lowest moisture content and this makes it to have a longer shelf life than other pretreated flours. The pretreatment had effect on the functional properties of the plantain flour samples. Flour treated with sodium metabisulphite had the highest water absorption capacity and third gave it its higher affinity to absorb water during production. The absorbent nature of the said flour has quantitative advantages and can be regarded as been economical

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