CHEMICAL COMPOSITIONS OF RIPE AND UNRIPE BANANA AND PLAINTAIN.

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Abstract

Objectives: Ripe and unripe plantains were obtained from Ado Ekiti markets and were made into flour. The chemical compositions of ripe and unripe flour were investigated. The following results were obtained for ripe plantain flour; moisture contents 61.3%, protein contents 3.15%, ash contents 6%, fat contents 1.2%, crude fibre 1.11%, sugar contents 12.8%, carbohydrate 27.24%, and total solid 38.7g / 100g. while the following results were obtained for unripe plantain flour; moisture contents 38.5%, protein contents 2.8%, ash contents 3.8%, fat contents 0.2%, crude fibre 0.7%, sugar contents 5.53%, carbohydrate 54%, and total solid 61.5g/100g.

The results of the chemical analysis indicate that the chemical composition for plantain vary in proportion to their maturity. Hence. Unripe plantain flour can be used as a composite flour in baking industry and can be better stored because of its low moisture contents (38.5%) compared to that ripe plantain flour which had high moisture contents (61.3%) thereby limiting its usage in food industry. Ripe plantain had high sugar contents (12.8%) as a result of the conversion of starch to sugar thus making it susceptible to high deterioration by biochemical and microbial actions; however it is suitable for human consumption.

Key words: Plantain, flour, deterioration, fiber

Introduction

Plantain plants are monocotyledonous, perennial and important crops in the tropical and sub-tropical regions of the world [1]. They include desert banana, plantain, and cooking bananas. Traded plantain (paradisiacal AAB) and other cooking bananas (Musa ABB) are entirely derived from AA.BB hybridization of M. acuminate (AA) and M. balbisiana (EB) [2]. Plantain and cooking bananas are very similar to unripe and desert banana (M. Cavendish AAA) in exterior appearance, although they are often larger. The main difference in the former being that their flesh is starchy rather than sweet, they are used as unripe and required cooking [3]. Bananas are consumed usually as ripe fruits where - as ripe and unripe plantain fruits are consumed boiled or fried.

From the nutritional pint of view, these fruits are among the green vegetables with the richest iron nutrient contents [4]. However, they are highly perishable and subjected to fast deteriorations, as their moisture contents and high metabolic activity persist after harvest [5]. Air drying alone or together with sun drying is largely used for preserving unripe plantain. Besides helping preservation, drying adds values to plantain.
Dietary fiber, resistant starch, proteins and mineral contents in industry elaborated when increases wheat flour by 7% of unripe plantain flour, as shown by Pacheco-delahaye [6]. Who also showed that starch is the main component of unripe plantain flour (84%) and reported the contents of protein as (6.8%), fat (0.3%) and dietary fiber (0.6%). Juarez – Garcia et al (2006) [7] also reported that banana flour was mainly I of total starch (73.6%) and dietary fiber (4.52%), plantain chip is one of the most valuable products with crispy and unique taste, consumed as a snack and as an ingredients of breakfast cereals. It can be consumed as produced of further processed by coating with sweetness, frying, dehydrating on boiling [8] an important characteristics of ripening in plantain is the increase in the rate of respiration known as climacteric rise [8]. In the process of ripening, the cell wall composition and structure of the fruit are reported to change resulting in the softening of the fruit.

Ethylene production and sensivity: Plantains are sensitive to physiological changes as low 0.3 to 0.5 uL⁻¹ if the levels are similar to those found in outside fresh air [6]. The three main factor affecting responses to external ethylene are: fruit maturity; time of harvest when ethylene exposure began, and the length of exposure to ethylene.

Extensive work has been done on the storage, processing, production of various products from ripe and unripe plantains, (Ketiku, 1978) [8]. Therefore, this present work is aimed at investigating the chemical compositions of ripe and unripe plantain flour and its benefits in human diet.

**Materials and Methods**

The ripe and unripe plantains were bought from Ado Ekiti market. The plantains were well peeled, cut into small sizes and dried in an air at 60⁰C. The dried plantain was milled (ripe and unripe plantain were milled separately) using hammers mill into flour, the plantain (ripe and unripe) flour were then subjected to proximate analysis.

Flow chart on the production of ripe and unripe plantain flour

Plantain (ripe and unripe)

<table>
<thead>
<tr>
<th>Peeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slicing</td>
</tr>
<tr>
<td>Drying  (air oven at 60⁰C)</td>
</tr>
<tr>
<td>Milling</td>
</tr>
<tr>
<td>Sieving</td>
</tr>
<tr>
<td>Ripe and unripe Plantain flour</td>
</tr>
</tbody>
</table>

Source: Ketiku [8].

**Proximate Analysis**

**Moisure Contents Determination**

Aluminum dishes were washed and dried in an oven. The dishes were weighed and recorded. 5g of the samples were weighed into the aluminum dish. The dishes were placed in an oven regulated at 105⁰C for 3hours during which time the weight was checked at specific time interval. This was done until constant weight was observed. This made it possible to obtain the moisture content of the original weight of the sample.
Determination was carried out in duplicate for each sample.

**Crude Fibre Determination**

2.7g of the sample was weighed into a dry 100ml conical flask. 200ml of 0.25N H$_2$SO$_4$ acid was added to the sample and then brought to boiling point. It was boiled gently for 30 minutes. The flask was rotated every few minutes in order to mix the contents and to remove particles from the sides. A funnel with a filter paper was prepared. At the end of the 30 minutes boiling period, the acid mixture was allowed to stand for one minute and poured immediately into a shallow layer of hot water under gentle suction in the prepared funnel. The suction was adjusted so that at the end, 200ml of the filtrate was completed within 10 minutes. The insoluble matter was washed with warm water gently until the washing was free of acid and then washed back into the conical flask by means of a wash bottle containing 200ml of 0.25N hydroxide solution and then boiled it was for 30 minutes as in previous boiling. After boiling it was allowed to stand for one minute and then filtered immediately through a suitable filter paper. The insoluble matters were then transferred into an already weighed crucible, then placed in a muffle furnace and heated 600$^\circ$C. The crude fibre was then determined by subtracting the weight of ash sample from the weight of the dried matter. The percentages crude fibre was calculated.

**Determination of Fat Contents**

The fat contents in the sample were determined by weighing 5g of each of the sample into a thimble which are in turn filtered into the reflux flask and the round bottom flask was weighed and filled with diethyl ether provided to about two – third volume of the flask. The thimble and the flask were fixed together and the whole soxhlet apparatus was set and was left some days for the fat to be extracted into the flask and for the diethyl ether to evaporate.

The flask was then dried in air oven (100$^\circ$C) for 39 min, cooled, weighed and the fat content was then calculated.

**Ash Determination**

5g of sample were weighed into an already weighed crucible and then placed in a muffle furnace at 600$^\circ$C. The sample was kept for 3 hours. After 3 hours, the crucible was removed and cooled in the desiccators. The sample was weighed after cooling after cooling the percentage ash was calculated.

**Protein Content Determination**

**Digestion**

0.5g of dry sample was weighed into 50ml kjedah flask 5ml of concentrated, H$_2$SO$_4$ was then added into a digester and then placed on the heater for about 15 minutes and finally at high heating temperature until digestion was achieved. The digestion was then allowed to cool and the sample residue was washed and filtered.

**Distillation**

5ml of 2% boric was measured into 100ml conical flask (as receiving flask). The 3 drops of mix indicator (bromocresso green plus methyl red in 200ml alcohol). The receiving flask was then placed so that the tip of the condenser tube was below the surface of the boric acid. 5ml of sample rich in Nitrogen and 10ml of sample low in Nitrogen were put into the Markham distiller and 10ml of 40%NaOH was added, the joint was tightened. It was then distilled until about 50ml was received.

**Sugar Determination**

5g of the sample were weighed into 50ml of volumetric flask and made up to the mark.
The sample poured into an empty conical flask.

The mixture was poured into the burette and 10ml of equal Fehling solutions were poured into empty conical flask and 15ml of the sample in the burette into the 10ml Fehling solution and put on the Bunsen burner 1 or 2 drops of methylene blue were added into burette until the colour finally changed. The titer value was recorded.

Carbohydrates was determined by the calculation \( CHO = 100 - (\text{Protein} + \text{moisture} + \text{fat} + \text{Ash}) \)

**Results and Discussions**

**Results**

The results of the analysis carried out on ripe and unripe plantain flour are as follows:

**Table 1: Proximate Analysis of Ripe Plantain Flour**

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Ripe Plantain Flour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content</td>
<td>61.3%</td>
</tr>
<tr>
<td>Protein content</td>
<td>3.15%</td>
</tr>
<tr>
<td>Ash content</td>
<td>6.0%</td>
</tr>
<tr>
<td>Fat content</td>
<td>1.2%</td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>1.11%</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>27.24%</td>
</tr>
<tr>
<td>Sugar content</td>
<td>12.8%</td>
</tr>
<tr>
<td>Total Solid</td>
<td>38.7g/100g</td>
</tr>
</tbody>
</table>

**Table 2: Proximate Analysis of Unripe Plantain Flour**

<table>
<thead>
<tr>
<th>Analysis Unripe Plantain Flour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Ash</td>
</tr>
<tr>
<td>Fat</td>
</tr>
<tr>
<td>Crude Fiber</td>
</tr>
<tr>
<td>Carbohydrates</td>
</tr>
<tr>
<td>Sugar content</td>
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<tr>
<td>Total Solid</td>
</tr>
</tbody>
</table>

**Discussions**

Table 1 and 2. Show the proximate composition of ripe and unripe plantains. There is an increase in the moisture contents as the plantain changes which could be as a result of moisture transfer from the peel to the pulp.

The carbohydrate in the unripe is higher than the ripe one, while the sugar contents in ripe is higher than that of the unripe ones.

This could be due to the fact that the starch contents decrease as the plantain ripens which is due to the conversion of starch to sugar which leads to the increase in the sugar contents of the ripe plantain.

There is a little increase in the proteins, Ash, fat, and crude fiber in the ripening stage.

**Conclusion and Recommendation**

**Conclusion**

From the results of analysis carried out in comparison with past works done in previous researches, moisture contents increase with decrease in the level of some nutrients in the ripe plantain flour in comparison with unripe plantain flour. Moisture contents in ripe plantain bring
about difficulty in storage thereby limiting its usage in food industry.

The unripe plantain flour has a very good quality with higher nutrients and can be used a composite flour to produce highly nutritive products.

**Recommendation**

Unripe plantain is very high in starch which makes it useful in industrial production of starch. The ripe plantain is very high in sugar content and because of this, ripe plantain is not recommended for diabetic patients.

Also, due to the high moisture contents in ripe plantain flour, it is highly perishable therefore a technology for the storage to extend the shelf life of the ripe plantains is required.

Unripe plantain flour can be added to other types of flour like groundnut, soyabean flour or wheat flour to produce a highly nutritive product which will be of benefits to human diet.

**References**

1. Stresses, H; Schoofs, H; panis, B; Andre, E; Reynersnievs, K; and Swennen R (2006) Development of Embryogenesis cell suspensions from shoot meristematic tissues of Banana and Plantain (Musa spp) Plant Science. 170: 104 – 112

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