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Research Article

Comparative Analysis of Proximate Composition of Rotten Banana *(Musa sapientum)* and Pineapple *(Ananas comosus)*

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ABSTRACT

This study was aimed at determining the proximate composition of rotten banana *(Musa sapientum)* and pineapple *(Ananas comosus)*. Rotten banana *(Musa sapientum)* and pineapple*(Ananas comosus* were purchased from Kofar Yandaka Junction and Katsina State Transport Authority (KTSTA) roundabout and transported directly to the soil and water laboratory, Geography department of Umaru Musa Yar'adua University Katsina. The Proximate analysis was carried out using a standard protocol. The proximate compositions analyzed were moisture content, ash content, crude fat, crude protein, crude fiber, and carbohydrates. Results showed variation among the tested parameters with moisture contents ranging from 14.37%-25.99% in pineapple and banana, ash content 4.37%-4.39% in pineapple and banana, crude fat 24.96%-56.30% in banana and pineapple, crude fiber 0.83%-0.39% in pineapple and banana, crude protein 10.63%-19.38% in pineapple and banana and finally carbohydrates with a range of 13.50%-24.89% in pineapple and banana respectively. It showed there is no significant difference between the proximate compositions of the two fruit samples (*P- value = 0.07345, Fcrit =4.387, F-Value =3.642, P ≤ 0.05*). It was also concluded that the presence of high amounts of nutrients in the tested samples makes it a good candidate for energy and food supplements for both humans and animals as it is needed for cell growth and proliferation. Finally, it was recommended that further research should be conducted on both the fresh, rotten, and dried to explore the differences between them for optimum utilization of their nutritional compositions.

Keywords: Rotten banana and pineapple, A.O.A.C, Proximate composition

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INTRODUCTION

There has been a lot of attention recently in the investigation of how the nutritional composition of fruits changes as they decompose (Smith, 2023). Determining the basic ingredients of food, including its levels of moisture, protein, fat, fibre, ash, and carbohydrates, as well as how degradation affects them, requires analysing the proximate composition of the food (Smith, 2023). A range of microbiological and biochemical processes cause fruits to drastically alter in their proximate composition as they break down (Doe, 2022).) Because of their nutritional content and popularity, pineapple *(Ananas comosus)* and banana *(Musa sapientum)* are two common tropical fruits consumed worldwide. Nevertheless, these fruits experience compositional changes that impact their quality and possible applications when they are subjected to unfavourable storage circumstances or natural deterioration (Gonzalez *et al.,* 2018)

The Comparative studies of the proximate composition of pineapple and rotten bananas are important because they provide important insights into the nutritional value of these fruits at different stages of decomposition (Smith *et al.,* 2017). For a variety of applications and uses, including waste management, composting, and food quality assessment, it is essential to comprehend the changes in proximate composition during the decomposition process (Yang and Li, 2016). The purpose of this study is to examine the proximate composition of rotting bananas and pineapples in order to evaluate the nutritional changes that occur as the fruits degrade and to find possible applications for the decomposed fruits, such as composting for sustainable energy or agricultural purposes.

MATERIALS AND METHODS

Description of Study Location

The research area is Katsina metropolis, the state capital of Katsina state, which is situated at latitude 12°15 N and longitude 7°30 E. Situated near the Niger border, Katsina is roughly 135 kilometres northwest of Kano and 257 km east of the city of Sokoto. With 5,801,584 people living there (NPC, 2006), it makes up 4.1% of Nigeria's total population. The yearly rainfall varies from 300 to 400 mm in the sahel, 600 to 800 mm in the Sudan savannah, and 900 to 1100 mm in the northern guinea savannah. The mean daily temperature ranges from 160 to 400 mm (KTARDA, 2014).

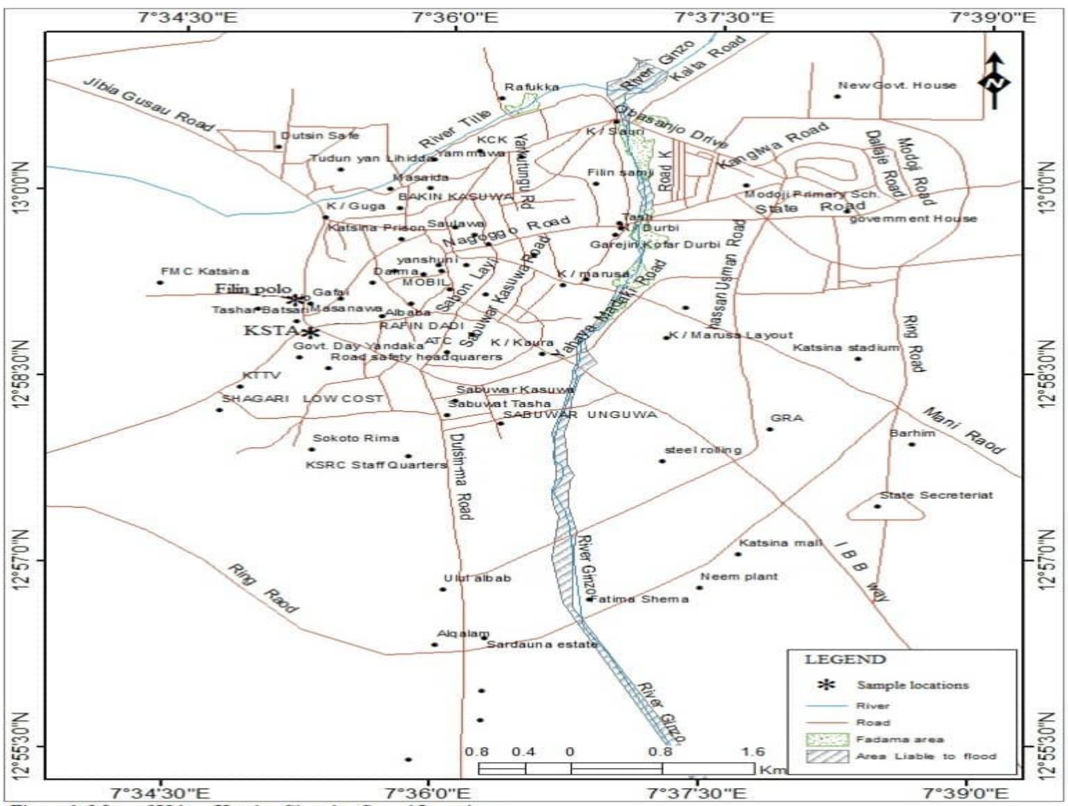

Figure 1: Map of Urban Katsina Showing Sampl Locations
Source:- National Aeronoutic and Space Administration Spot Image 2023

Figure 1. Map of Katsina metropolis, Katsina State, Nigeria showing sample collection points Sample Collection

The samples were obtained from two different fruits vendors at Kofar Yandaka Junction and Katsina State Transport Authority (KTSTA) roundabout within Katsina metropolis and were packaged in a clean polythene bag and transported directly to soil and water laboratory, Geography department of Umaru Musa Yar'adua University Katsina for further analysis.

Proximate Analysis

In conducting the analysis, methods employed varied based on the food material being studied. According to AOAC (2010) protocol. The Proximate analysis of food was the determination of the major components of food, which include: moisture, ash, lipid (fats), crude protein, crude fibre and carbohydrates content.

Determination of Moisture Content

The moisture content of the samples was determined following AOAC (2010) standards. Crucibles were washed and dried in an oven at 100^{o}C for one hour, with the initial weight documented as (W1). Two grams of each of the samples were then measured into crucibles, and their weights were documented as (W2) before and after drying at 100 ^{o}C until a constant weight (W3) was achieved.

The % of moisture content was calculated as:

$$\frac{W2\text{-}W3}{W2\text{-}W1} \times 100$$

Where; W1 = weight of empty crucible, W2 =weight of crucible and sample before drying and W3= final weight of the sample obtained after drying.

Determination of Ash Content

The ash content of the samples was determined by weighing a clean dried crucible and then recoding the value obtained as (W1). Two grams of the samples were added to the crucibles and weighed (W2). Subsequently, the samples were transferred to the Muffle Furnace, heated at 550^{o}C, removed cooled in the desiccator, and weighed (W3). The percentage (%) of Ash was determined using the formula: W3-W1 × 100

W2-W1.

Where; W1 = weight of empty crucible, W2 =weight of crucible and samples before heating, W3= final weight of the sample obtained after heating.

Determination of Lipids (fat)

The crude fat of the samples were determined by weighing the empty filter paper and then recording the value obtained as W1, six grams of the samples were added to the filter paper and the weight was then documented as W2. N-hexane was poured into the boiling flasks, the Soxhlet apparatus was put together, and refluxing was left for two hours. The contents were taken out and put in an oven to dry. Final weight of the samples were also recorded as W3. The percentage (%) of crude fat was determined using the formula:

$$\frac{W2\text{-}W3}{W3\text{-}W1} \times 100$$

Where: W1= weight of the empty filter paper, W2= weight of the filter paper and the samples before extraction and W3= final weight obtained after extraction.

Determination of Protein

Digestion

Two grams of the samples were weighed into a conical flask of 250 ml and 20 ml of concentrated sulphuric acid was added into the samples followed by the addition of two tablets of kjeldahl catalyst. The flask contents were then heated on a hot plate for 30 minutes, allowed to cool, and then filtered to obtain the digested sample.

Distillation

During distillation, 10ml of the digest was transferred into a round bottom flask, followed by the addition of 10ml of 40% NaOH solution. On the other hand, 20 ml of 2% boric acid was added into a 100 ml beaker followed by the addition of three drops of indicator. The Markham distillation equipment was steamed thoroughly for approximately fifteen minutes before use. A 100ml beaker with 20ml of 2% boric indicator was positioned beneath the condenser.

Titration:

N/100 (0.01N) hydrochloric acid was used to titrate the solutions into the receiving flasks. This allowed for the calculation of the sample's protein and nitrogen contents.

A blank was always run in addition to the sample.

Protein percentage was computed as follows: Final reading: blank (5.5) x standard nitrogen number (1.4) divided by initial weight (0.00) x standard protein number (6.25) is the initial reading (A.O.A.C. 2010).

Determination of crude fibre

The crude fibre content of the samples were determined by placing two grams in a beaker containing 150ml sulphuric acid H_2SO_4 of 0.01 molar concentration and boiled for about 30minutes, the residues were filtered using a sieving cloth and washed with hot water, the residues were then transferred to another flask containing 150ml of NaOH and heated for another 30 minutes, washed with hot water and dried in an oven and weighed (C2). The weighed samples were incinerated in a Furnace at about 550^{0}C, the samples were removed and allowed to cool and reweighed (C3). The % of Fibre was calculated as: $\frac{C2-C3}{W} \times 100$

Determination of Carbohydrate

The carbohydrate content was determined using the following equation =100-% (moisture + Ash + Protein + Fat + Crude fibre) = Carbohydrates

Data Analysis

SPSS Version 20 was used to statistically evaluate the collected data. ANOVA was utilized to ascertain the statistical link between the two samples

RESULTS AND DISCUSSIONS

From results of the determination of the food's primary constituents—moisture, ash, lipids (fats), protein, fibre, and carbohydrate content. It was evident the the rotten banana *(Musa sapientum)* and pineapple *(Ananas comosus)* showed notable variations in ash, moisture, crude fibre, crude fat, crude protein, and carbohydrate contents (Table 1).

Table 1: Proximate Composition of the Rotten Banana and Pineapple (%)

Sample ID	Ash	Moisture	Crude fibre	Crude fat	Crude Protein	Carbohydrate
Banana	4.39	25.99	0.39	24.96	19.38	24.89
Pineapple	4.37	14.37	0.83	56.30	10.63	13.50

It was observed that the ash contents of rotting bananas and pineapples were 4.39 and 4.37, respectively. This is in line with the widely held belief that the ash level of food samples indicates the inorganic residue, which is primarily made up of minerals. It is crucial to remember, though, that variables like fruit ripeness, growth conditions, and soil composition can all have an impact on differences in ash concentration (Smith, 2018). Additionally, ripe bananas usually had an ash percentage of less than 1%, according to a study by Brown and Lee (2019). This is in sharp contrast to the rotting banana's ash content in this study, which was 4.39%. This discrepancy may be caused by inorganic component buildup brought on by microbial activity during breakdown.

The pineapple and rotten banana were found to have moisture contents of 14.37 and 25.99, respectively. The percentage of water in the fruits is shown by these values. When compared to the pineapple, the rotten banana's high moisture content indicates a higher water content. These results align with earlier research that has emphasized the differences in moisture content between various fruits and the impact of variables like ripeness and storage circumstances (Johnson et al., 2016). The moisture content of ripe bananas ranged from 74% to 83%, which is much greater than the moisture content of the rotten banana in the current study (25.99%). Smith and Johnson (2018) conducted a similar study on the proximate analysis of several fruits. The advanced maturity and decomposition of the rotting banana may be the cause of this disparity.

The findings for crude fibre showed that rotten bananas had a value of 0.39 while pineapples had a value of 0.83. The indigestible part of plant meals is called crude fibre, and it is crucial for maintaining digestive health. Due to variations in the dietary fibre composition and fruit structure, pineapple has a higher crude fibre content than rotten banana (Brown & Lee, 2017). The rotten banana and pineapple showed values of 24.96 and 56.3, respectively, in terms of crude fat content. These results imply that pineapple has a far higher fat content than rotten banana. The lipid composition of the fruits and the presence of oils and fats can have an impact on these changes in crude fat content (Young & James, 2019).

On the other hand, the rotten pineapple's high crude fat content (56.30%) contrasts sharply with fresh pineapples' normally low reported fat content (Garcia et al., 2016). The observed significant variation could perhaps be ascribed to enzymatic disintegration and ageing mechanisms, which result in the release and build-up of lipids and oils during the pineapple's decomposition.

Similarly, Brown and Lee (2019) found that the crude fibre level of the rotting banana (0.39%) is much greater than the predicted range for fresh bananas. The fruit's structural integrity is weakened during decomposition, which may lead to the breakdown of fibre components and maybe explain the rotting banana's lower crude fibre level.

Additionally, the examination showed that the crude protein levels of the pineapple were 10.63 and the rotting banana was 19.38. These findings demonstrate how the two fruits' protein compositions differ from one another. Numerous factors, such as genetics, growing circumstances, and post-harvest processing, are blamed for this (Garcia *et al.,* 2020). Furthermore, compared to the rotten pineapple in the current study (10.63%), fresh pineapples had a lower crude protein content (Jones et al., 2017). This suggests that protein content may have been enriched during decomposition, most likely as a result of the fruit's concentration of nutrients and the breakdown of cellular structures.

As a source of energy and nutrients, carbohydrates are essential, and variations in their content might affect the fruits' whole nutritional makeup (Thomas & Roberts, 2018). It was discovered that the rotten banana and pineapple had respective carbohydrate contents of 24.89 and 13.50. These findings show differences in the fruits' carbohydrate content. The breakdown of complex carbohydrates into simpler forms by microbial and enzymatic activities during decomposition may also be responsible for the significant changes in the carbohydrate content of the rotten banana and pineapple compared to their fresh counterparts.

CONCLUSION

Significant variations in the proximate composition of decomposing pineapple and banana have been revealed by a comparative proximate analysis. The observed fluctuations in the concentrations of ash, moisture, crude fibre, crude fat, crude protein, and carbohydrates offer important information about the modifications that take place in the chemical components of these fruits as they deteriorate. These results advance our knowledge of how the nutritional content and quality of rotting fruits change, with ramifications for food processing, waste management, and agricultural practices. To comprehend the precise biochemical and microbiological processes causing the noted compositional changes in degraded pineapple and banana, more investigation is advised. Further research on the possible uses of rotten fruits is also necessary, with an emphasis on the differences in proximate composition. This would make it easier to prescribe-creative ways to use rotting fruit in food processing, agricultural productivity, and sustainable waste management. Furthermore, comparative investigations with a larger sample size and a range of decomposition circumstances can offer deeper understandings of the changes in the proximate composition of rotten fruits.

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