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Phytochemicals and Proximate Composition of Cocoyam Flour and Banana Flour from Some Selected Indigenous Varieties in Akwa Ibom State.

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ABSTRACT

This study investigates the proximate and phytochemical composition of flours produced from selected varieties of indigenous cocoyam and banana flour in Akwa Ibom State. The proximate and phytochemical composition of the sample flours were determined using Standard laboratory methods. The result of the analysis was collected in triplicate and subjected to statistical analysis using SPSS and Microsoft Excel. The results were presented in tables and graphical illustrations. From the result of the analysis, it was observed that Cocoyam flour samples exhibited higher ash (7.43%), fiber (4.7%), and protein (8.67%) content compared to banana flours, with C3 flour from cocoyam showing the highest mineral density. Banana flours, particularly B1, were more carbohydrate-dense (88.13%), suggesting their suitability for energy-rich formulations. Phytochemical analysis revealed the presence of potentially harmful compounds like hydrogen cyanide, tannins, oxalates, and phytates, which can impact both nutrition and safety in both Banana and Cocoyam flour. High levels of HCN were observed for B3 flour (3.29 mg/kg), with lower values of 1.37 mg/kg observed for C2. Tannin content ranged from 1.69 mg/kg (C2) to 7.57 mg/kg (C3). Oxalate content ranged from 8.73 mg/kg (C2) to 20.37 mg/kg (B1), and phytate content ranged from 3.95 mg/kg (C1) to 11.70 mg/kg (B3). In conclusion, it can be proposed that that both flours hold great potential for food applications, provided appropriate processing techniques are applied to maximize their nutritional benefits and minimize health risks. It is hereby recommended that local food industries should adopt the utilization of banana and cocoyam flours in bakery products to promote food diversification and reduce dependence on wheat flour.

Keywords: Cocoyam, Banana, Phytochemical, Proximate composition, Flour, Food Formulation

1.0 Introduction

Developing nutritious and appealing food products is important for promoting the consumption of underutilized plant-based foods. Among such foods, banana (*Musa spp.*) and cocoyam (*Colocasia esculenta*) are widely cultivated staple crops in tropical and subtropical regions, playing a significant role in food security and nutrition. These crops are rich in essential nutrients, including carbohydrates, dietary fiber, vitamins, and minerals, making them vital components of a healthy diet (FAO, 2013). Despite their nutritional benefits, their potential in flour production remains largely unexplored. This study focuses on evaluating the phytochemical and proximate composition of banana flour and cocoyam flour obtained from selected indigenous varieties in Akwa Ibom State, Nigeria, to assess their nutritional viability and potential for food applications.

Traditionally, banana and cocoyam have been integral to the diets of indigenous communities in Akwa Ibom State. Cocoyam is commonly consumed with beans or processed into *Ekpang Nkukwo*, a native dish prepared by grating and mixing it with aerial yam. On the other hand, banana is widely utilized in dishes such as porridge, boiled with red oil, or processed into *Ato Mboro*, a local banana-based delicacy. These foods have historically contributed to overall well-being, offering significant health benefits and reducing the prevalence of diet-related diseases such as diabetes, hypertension, and cancer.

The increasing interest in utilizing banana and cocoyam as alternative ingredients in food products has led to the exploration of their potential in flour production. Processing these crops into flour offers several advantages, including prolonged shelf life, reduced post-harvest losses, and enhanced versatility in food product development (Mohan et al., 2008). Banana flour is a rich source of potassium, vitamin C, vitamin B6, and dietary fiber, and it contains phytochemicals with antioxidant properties that may reduce the risk of heart disease and certain cancers (Kumar et al., 2017). Similarly, cocoyam flour is abundant in complex carbohydrates, fiber, and essential minerals such as potassium, magnesium, and iron. It also possesses bioactive compounds with anti-inflammatory properties (Zhang et al., 2018).

The application of composite flour technology, where non-wheat flours are blended with wheat flour, presents an opportunity to improve the nutritional quality of baked goods while reducing dependence on imported wheat (Olaoye & Ade-Omowaye, 2011). The rising consumer demand for functional foods that provide health benefits beyond basic nutrition has further fueled interest in alternative flours (Baba *et al.,* 2015). Additionally, food waste remains a critical challenge in the industry, particularly from fruit processing operations, which generate significant waste from juice, jam, and puree production. The conversion of banana and cocoyam into flour could help mitigate food waste and create value-added products for both industrial and household applications (Bertagnolli et al., 2014).

Given the high moisture content of banana and cocoyam, they are highly perishable and susceptible to microbial spoilage. Processing them into flour enhances their storage stability and expands their industrial applications (Emaga *et al.,* 2007). Understanding the proximate and phytochemical composition of these flours is essential for evaluating their nutritional contributions and potential health benefits.

Cocoyam is widely recognized for its medicinal and nutritional properties, particularly in managing chronic diseases. It is rich in dietary fiber, which aids digestion, prevents constipation, and promotes gut health by fostering beneficial gut bacteria (Mensah et al., 2018). The high potassium content in cocoyam supports cardiovascular health by regulating blood pressure and reducing the risk of hypertension and stroke (Onimawo & Egbekun, 2019). Additionally, its bioactive compounds exhibit antioxidant and anti-inflammatory properties, potentially lowering the risk of chronic illnesses such as diabetes and certain cancers (Adebayo et al., 2020). Its low glycemic index makes it a suitable food for individuals with diabetes, as it helps regulate blood sugar levels (Ekpenyong & Akpan, 2017). Moreover, the presence of essential minerals such as magnesium, iron, and zinc support bone health, red blood cell production, and immune function, making cocoyam a valuable functional food (FAO, 2016).

Similarly, banana is a nutrient-dense fruit with several medicinal properties. It is an excellent source of potassium, which helps regulate blood pressure and supports cardiovascular health (Kumar et al., 2017). Bananas contain resistant starch and dietary fiber, which improve digestion, promote gut health, and assist in blood sugar regulation, making them beneficial for individuals with diabetes (Bello et al., 2018). Additionally, they are rich in antioxidants, including dopamine and vitamin C, which help reduce oxidative stress and the risk of chronic diseases such as cancer and neurodegenerative disorders (Zhang *et al.,* 2018). Bananas also contain vitamin B6, which plays a crucial role in brain function and neurotransmitter production, contributing to mood regulation and preventing depression (Olaoye & Ade-Omowaye, 2011). Their natural anti-ulcer properties protect the stomach lining, further promoting digestive health (Emaga *et al.,* 2007).

This study seeks to explore the proximate and phytochemical composition of banana and cocoyam flours from selected three indigenous varieties in Akwa Ibom State. The findings will provide valuable insights into their nutritional potential and applicability in food product development, ultimately promoting their utilization as functional food ingredients.

2.0 Materials and Methods

2.1 Study Area

The study was conducted in Uyo Metropolis, the capital of Akwa Ibom State where the University of Uyo is located. Akwa Ibom State is one of the thirty-six States in Nigeria, located within the South – South geo-political zone. Bordered on the East by Cross River state.on the west by Rivers state and Abia States on the south by Atlantic Ocean. Nigeria is one of the countries in West Africa. Uyo, capital of akwa Ibom State is situated at 5.0377º N and 7.9128^0 E. It occupies a land mass of 362 km^2 and has 31 Local Government Areas (LGA). Uyo lies in partly in the rain forest and swampy mangrove region of Nigeria.

2.2 Sample Collection Sources

The three Banana and cocoyam varieities were purchased from Kpo-kpo market located at Ekom Iman Junction. This market holds the boundary between Uyo and Etinan L.G.A. Afterwards, these items were transported to the Home Economics Laboratory, Faculty of Agriculture, University of Uyo for processing for processing into flour.

Fig. 1a: *Musa Acuminata*

Fig. 1b: *Musa Sapientum*

Fig. 1c: *Nanyanagudu rasable*

Fig. 2a: *Colocasia esculenta var. antiquorum* **(Plant).** **Fig. 2b:** *Colocasia esculenta* **(Comb)**

Fig. 3a: *Xanthosoma atrovirens* **(Plant).** **Fig. 3b:** *Xanthosoma atrovirens* **(Comb)**

Fig. 4a: ***Xanthosoma sagittifolium*** **(Plant).** **Fig. 4a:** ***Xanthosoma sagittifolium*** **(Comb)**

2.3. Sample Processing

2.3.1 Processing of Cocoyam samples into flour:

The traditional method for processing Cocoyam for cooking was adopted. The traditional processing procedures for the cocoyam species were follows; The mature cocoyam species purchased from Kpo-kpo market were peeled with a kitchen knife, washed and sliced into tiny shapes. It was then sun-dried for 2 days to enable it loss some of the moisture gradually in a natural way before it was further oven-dried at the temperature of 50°C for 12hrs.

2.3.2 Processing of Banana samples into flour:

The traditional method for processing unripe Banana for cooking was adopted. The traditional processing procedures for cooking unripe species banana were follows; The mature banana species purchased from Kpo-kpo market were peeled with the use of kitchen knife to tear open each banana peel before it was gently removed. The unripe banana fruits were washed and sliced into tiny shapes. It was also sun-dried for 2 days to enable it loss some of the moisture gradually in a natural way before it was further oven-dried at the temperature of 50℃ for 12hrs.

After the Cocoyam and Banana specimens were well dried, they were further subjected to milling and passed through sieving with a mesh size of 55μm to obtain a fine powder flour which was then packaged in an air-tight cellophane bag and stored in an air-tight plastic container at 37℃ (room temperature). This method was adopted from (Sikarwar *et al.*, 2014). The cellophane bags were labelled B1, B2, B3 for the three different Banana varieties and C1, C2, C3 for the three different Cocoyam varieties

2.4 Determination of proximate composition of Banana and Cocoyam varieties

The flake-dried samples of the Banana and cocoyam specimen were then sent to the Biochemistry Laboratory, University of Uyo, for Analysis. The proximate composition determined for Banana and cocoyam flour, produce from (B1, B2, B3) and (C1, C2, C3) species included; moisture content, ash content, lipid content, protein content, and carbohydrate content. These values were analysed and determine using the method of Association of official Analytical chemist (AOAC, 2005). These parameters provide essential insights into the macronutrient composition of the Banana and cocoyam varieties and are important for assessing its nutritional value. Other Nutritional profile analyzed included Phytochemical parameter which were also determined using standardized analytical methods.

2.5 Food Toxicant

Food toxicant was determined using the alkaline picrate method. This involves four steps namely; Extraction of cyanide determination, preparation of cyanide standard curve, separation of alkaline picrate solution.

2.6 Statistical Analysis

All experiments and analyses were carried out in triplicates and the mean calculated. Data was subjected to analysis of variable (ANOVA) using the SPSS version 23 (SPSS, IBM, Chicago USA). Duncan multiple Range test (DMRT) will be used to separate means. Microsoft Excel 2007 was used for the graphical illustration of the sampled data.

3.0 Result and Discussion

3.1 Proximate Composition:

The result of the proximate compositions and phytochemical analysis of the three different varieties of Banana and Cocoyam is presented in table 3.1 and table 3.2 respectively.

Table 3.1: Mean and standard error values of Proximate Composition (%) of flours samples prepared from three different varieties of Banana (B1, B2 and B3) and Cocoyam (C1, C2 and C3)

Proximate Composition	B1	B2	B3	C1	C2	C3
Moisture (%)	1.22 ±0.01^{c}	0.98 ±0.00^{b}	1.30 ±0.06^{d}	0.87 ±0.01^{a}	1.37 ±0.01^{d}	1.16 ±0.01^{c}
Ash (%)	1.70 ±0.06^{a}	3.57 ±0.01^{c}	4.30 ±0.01^{d}	2.35 ±0.01^{b}	4.13 ±0.01^{c}	7.43 ±0.01^{f}
Fibre (%)	0.97 ±0.01^{a}	2.18 ±0.01^{c}	3.54 ±0.01^{e}	1.48 ±0.01^{b}	2.89 ±0.01^{d}	4.70 ±0.06^{f}
Protein (%)	6.40 ±0.06^{d}	4.80 ±0.06^{a}	5.08 ±0.00^{b}	5.93 ±0.01^{c}	7.60 ±0.06^{e}	8.67 ±0.01^{f}
Lipid (%)	1.83 ±0.01^{a}	5.74 ±0.01^{e}	2.18 ±0.01^{b}	6.08 ±0.01^{f}	3.37 ±0.01^{d}	2.69 ±0.01^{c}
CHO (%)	88.13 ±0.03^{f}	82.69 ±0.01^{c}	83.65 ±0.01^{e}	83.34 ±0.01^{d}	80.57 ±0.01^{b}	75.52 ±0.01^{a}
Caloric Value (Kcal)	393.98 ±0.01^{d}	401.85 ±0.00^{e}	374.45 ±0.04^{b}	411.80 ±0.06^{f}	383.60 ±0.06^{c}	360.83 ±0.03^{a}

Means with different super script along the same row are statistically sig.

Banana Specie 1 (B1): *Musa acuminate x balbisiana*; **Banana Specie 2 (B2):** *Musa Sapientum*

Banana Specie 3 (B3): *Nanyanagudu rasable;* **Cocoyam Specie 1 (C1):** *Xanthosoma atrovirens*

Cocoyam Specie 2 C2: *Colocasia esculenta var antiquorum;* **Cocoyam Specie 3 C3:** *Xanthosoma sagittifolium*

The proximate analysis of banana and cocoyam flours revealed significant variations in their moisture, ash, fiber, protein, lipid, carbohydrate, and caloric content. Moisture content ranged from 0.87% in C1 to 1.37% in C2, while for banana, it varied from 0.98% in B2 to 1.30% in B3. The low moisture levels across samples suggest enhanced storage stability and reduced microbial spoilage risk (Falade & Okafor, 2015). However, higher moisture content in C2 may increase susceptibility to spoilage, whereas B1's low moisture enhances its shelf stability (Eke-Ejiofor & Owuno, 2012).

Ash content, an indicator of mineral composition, ranged from 1.70% in B1 to 7.43% in C3. Cocoyam flours had generally higher ash content than banana flours, with C3 being the most mineral-rich sample, making it beneficial for bone health and metabolic functions (Adebayo-Oyetoro et al., 2017). This finding aligns with Emaga *et al.* (2017), who reported that cocoyam flour has higher mineral content than banana flour.

Crude fiber, essential for digestion and glycemic control, ranged from 0.97% in B1 to 4.70% in C3. Among banana species, B3 had the highest fiber content, while C3 had the highest among cocoyam species, suggesting their potential role in weight management and gut health (Mensah et al., 2019).

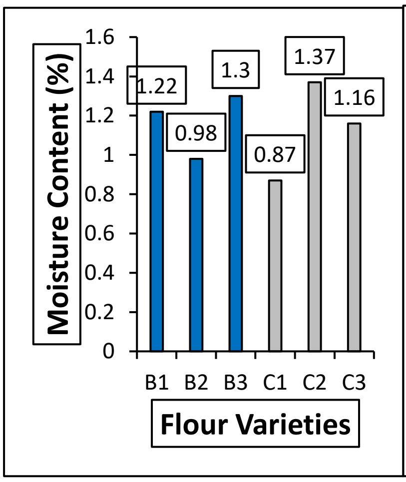

Fig. 3.1: Moisture contents

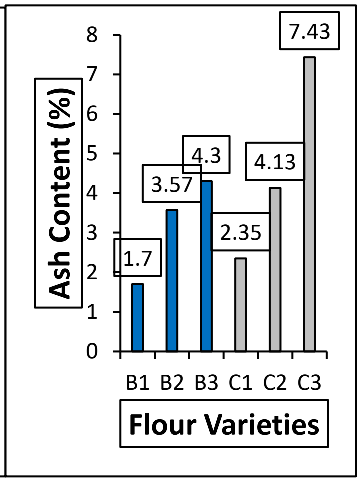

Fig. 3.2: Ash contents

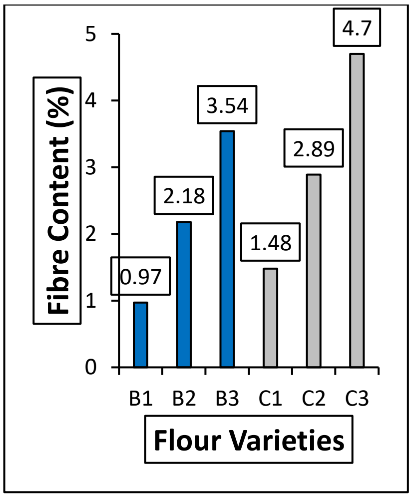

Fig. 3.3: Fibre contents

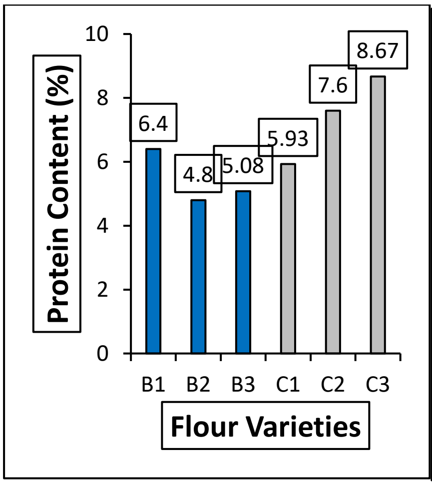

Fig. 3.4: Protein contents

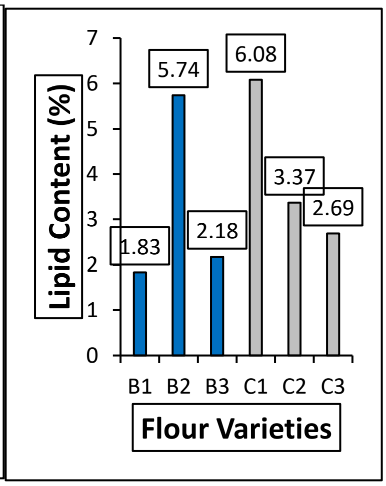

Fig. 3.5: Lipid contents

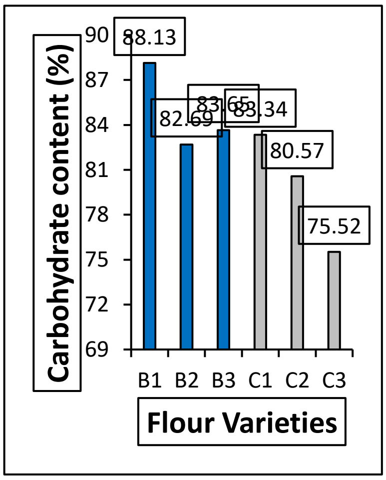

Fig. 3.6: CHO contents

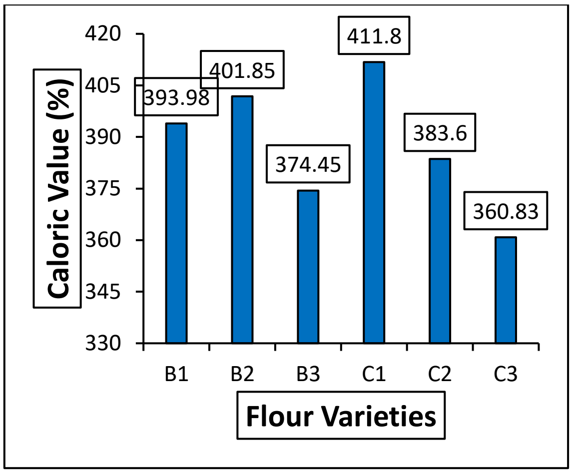

Fig. 3.7: Caloric value

Keys: **Banana Specie 1 (B1):** *Musa acuminate x balbisiana*; **Banana Specie 2 (B2):** *Musa Sapientum*

Banana Specie 3 (B3): *Nanyanagudu rasable;* **Cocoyam Specie 1 (C1):** *Xanthosoma atrovirens*

Cocoyam Specie 2 C2: *Colocasia esculenta var antiquorum;* **Cocoyam Specie 3 C3:** *Xanthosoma sagittifolium*

Lower fiber content in banana flours corroborates previous research by Onwuka & Ugwu (2020), indicating banana's starch-rich composition limits fiber levels.

Protein content ranged from 4.80% in B2 to 8.67% in C3. Among banana varieties, B2 had the lowest, while B1 had the highest protein content. In contrast, C3 was the most protein-rich cocoyam sample, making it suitable for plant-based diets. This supports findings by Onabanjo & Dickson (2021), who observed higher protein levels in cocoyam than banana flour. B3's higher protein content suggests its potential for protein-enriched formulations (Adepoju *et al.*, 2018).

Lipid content varied from 1.83% in B1 to 6.08% in C1, with B2 and C1 having the highest values, making them suitable for energy-dense food formulations. However, excessive lipid content can lead to faster rancidity (Ukhun *et al.*, 2016), whereas C3's lower lipid content enhances shelf life (Ezeocha & Ojimelukwe, 2020).

Carbohydrate content ranged from 75.52% in C3 to 88.13% in B1, with banana flours generally having higher carbohydrate levels than cocoyam flours, making them ideal for quick-energy foods. The high carbohydrate content in B1 aligns with findings that banana flour is rich in resistant starch, providing sustained energy and supporting gut health (Fagbemi et al., 2017). Lower carbohydrate levels in cocoyam flour may be beneficial for diabetic patients seeking low-glycemic index foods (Oladunjoye *et al.*, 2018).

Caloric values ranged from 360.83 Kcal in C3 to 411.80 Kcal in C1. Among bananas, B2 had the highest caloric value, while within cocoyam, C1 was the most energy-dense. Higher caloric values make these flours suitable for high-energy diets (Akinyele & Omodele, 2019).

Overall, banana flours are excellent energy sources due to high carbohydrate content, while cocoyam flours are richer in protein, fiber, and minerals, supporting balanced diets. C3 emerged as the most nutritious cocoyam species, while B2's high lipid content makes it ideal for energy-dense formulations. The low moisture content enhances storage stability, making these flours valuable for food applications and dietary planning.

3.2 Phytochemical Analysis:

The result of the phytochemical analysis of the three different varieites of Banana and Cocoyam is presented in 3.2.

Table 3.2: Mean and standard error values of Phytochemical Compositions of flours samples prepared from three different Varieties of Banana (B1, B2 and B3) and Cocoyam (C1, C2 and C3)

Proximate Composition	B1	B2	B3	C1	C2	C3
HCN	1.38 ±0.00^{b}	1.37 ±0.00^{a}	1.89 ±0.00^{d}	1.53 ±0.00^{c}	2.99 ±0.00^{e}	3.29 ±0.00^{f}
Tanin	6.95 ±0.00^{c}	1.69 ±0.00^{a}	7.57 ±0.00^{f}	4.55 ±0.00^{b}	7.23 ±0.00^{e}	7.14 ±0.00^{d}
Oxalate	10.46 ±0.01^{c}	8.73 ±0.00^{a}	11.54 ±0.01^{c}	20.37 ±0.01^{f}	12.12 ±0.00^{d}	14.07 ±0.00^{e}

Phytate	3.95 ±0.00[a]	4.59 ±0.00[b]	7.92 ±0.00[d]	7.78 ±0.01[c]	10.98 ±0.00[e]	11.70 ±0.00[f]

Keys: **Banana Specie 1 (B1):** *Musa acuminate x balbisiana*; **Banana Specie 2 (B2):** *Musa Sapientum*

Banana Specie 3 (B3): *Nanyanagudu rasable;* **Cocoyam Specie 1 (C1):** *Xanthosoma atrovirens*

Cocoyam Specie 2 C2: *Colocasia esculenta var antiquorum;* **Cocoyam Specie 3 C3:** *Xanthosoma sagittifolium*

Phytochemicals are bioactive compounds found in plants that contribute to their nutritional and health-promoting properties. Phytochemical compounds such as hydrogen cyanide (HCN), tannins, oxalates, and phytate analyzed in the present study can have both beneficial and adverse effects on human health. The results of the phytochemical composition of flour prepared from the selected banana species (B1, B2 and B3) and cocoyam species (C1, C2 and C3) presented in table 4.2 provides great insights into their potential nutritional and anti-nutritional impacts.

Hydrogen cyanide is a toxic compound that occurs naturally in some plant foods, particularly tubers and legumes. The results from the present study showed that HCN levels ranged from 1.37 mg/kg (C2) to 3.29 mg/kg (B3). Among the banana species prepared flours, B3 had the highest HCN content (3.29 mg/kg), while B1 had the lowest (1.53 mg/kg). Among the cocoyam species prepared flour, C3 had the highest HCN content (1.89 mg/kg), whereas C2 had the lowest (1.37 mg/kg).

The presence of HCN in these samples suggests the necessity of proper processing techniques such as soaking, boiling, drying, and fermentation to reduce cyanogenic toxicity. Studies by Oluwole *et al.* (2019) and Nwabueze & Odunsi (2021) have shown that fermentation and prolonged heating can significantly reduce cyanogenic glycosides in plant-based foods, making them safer for human consumption. In particular, fermentation reduces cyanide levels by up to 80%, as the process facilitates enzymatic breakdown and volatilization of cyanogenic compounds (Kumar *et al.*, 2020).

Tannins are polyphenolic compounds known for their antioxidant properties but can also interfere with nutrient absorption by binding to proteins and minerals. The result of the analysis showed that tannin content ranged from 1.69 mg/kg (C2) to 7.57 mg/kg (C3). Among the flour prepared from banana species, B2 exhibited the highest tannin content (7.23 mg/kg), while B1 had the lowest (4.55 mg/kg). Among the flour prepared from cocoyam species, C3 recorded the highest tannin content (7.57 mg/kg), whereas C2 had the lowest (1.69 mg/kg).

Higher tannins levels contribute to bitter flavors in foods and may reduce protein digestibility, but their health benefits, such as reducing oxidative stress, promoting cardiovascular health, and exhibiting anti-inflammatory effects, are well-documented (Ajibade *et al.*, 2018; Akinyemi *et al.*, 2021). High tannin levels in C3 and B2 suggest that these flours may provide stronger antioxidant benefits, though de-tanning techniques such as soaking, fermentation, or roasting can help improve palatability and protein availability (Makkar, 2019).

Oxalates are naturally occurring plant compounds that can chelate minerals such as calcium, thereby reducing their bioavailability. The oxalate content in the analyzed flour samples varied from 8.73 mg/kg (C2) to 20.37 mg/kg (B1). From the analyzed flour, that from banana species, B1 had the highest oxalate content (20.37 mg/kg), followed by B3 (14.07 mg/kg), and B2 (12.12 mg/kg); While the flours prepared from cocoyam species, C3 recorded the highest oxalate level (11.54 mg/kg) compared to C2 which had the lowest value (8.73 mg/kg). Eka and Idowu, (2022) reported that high oxalate levels in food can contribute to kidney stone formation and reduce calcium absorption. Therefore, it is very important to adopt preparation methods such as cooking and fermentation to reduce oxalate content in these plant-based flours.

Oxalate content variation may be due to genetic differences between species, soil composition, and post-harvest processing techniques. Cooking, soaking, and fermentation have been shown to reduce oxalate content by 30–50%, making food safer for consumption (Eka & Idowu, 2022). Thus, for individuals at risk of kidney stones, proper processing of these flours is essential before consumption.

Phytate are phytochemicals that can form insoluble complexes with essential minerals like iron, zinc, and calcium, reducing their bioavailability. The phytate content in the flour samples ranged from 3.95 mg/kg (C1) to 11.70 mg/kg (B3). Among the banana species, B3 flours had the highest phytate content (11.70%), while B1 flours had the lowest (7.78 mg/kg). considering the cocoyam species, C3 recorded the highest phytate content (7.92 mg/kg), while C1 had the lowest (3.95 mg/kg). Although phytates may limit mineral absorption, they also exhibit health benefits such as antioxidant properties and potential cancer-preventive effects.

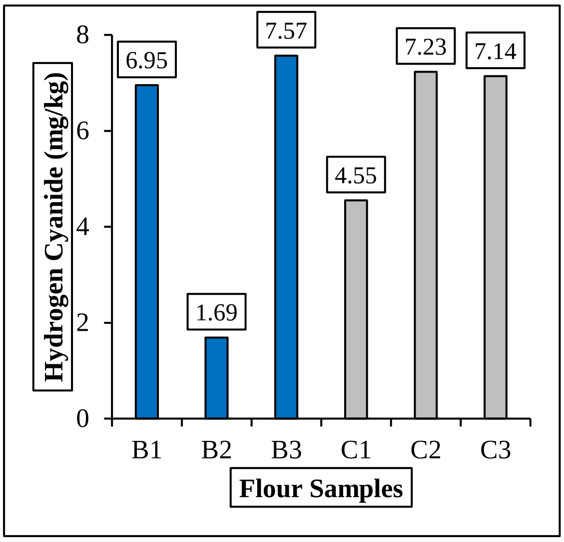

Fig. 3.8: HCN Content

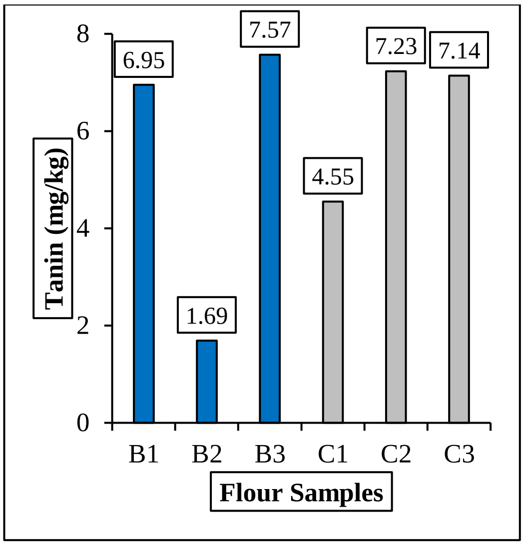

Fig. 3.8: Tannin Content

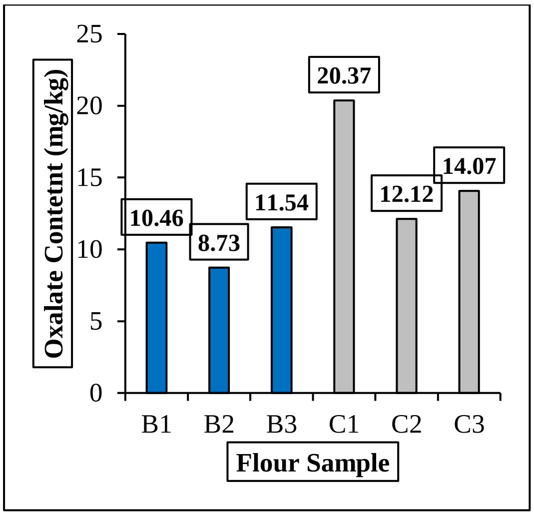

Fig. 3.8: Oxalate Content

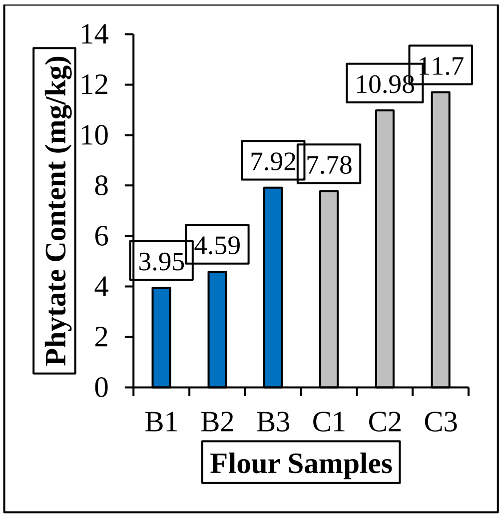

Fig. 3.8: Phytate Content

Banana Specie 1 (B1): *Musa acuminate x balbisiana*; **Banana Specie 2 (B2):** *Musa Sapientum*

Banana Specie 3 (B3): *Nanyanagudu rasable;* **Cocoyam Specie 1 (C1):** *Xanthosoma atrovirens*

Cocoyam Specie 2 C2: *Colocasia esculenta var antiquorum;* **Cocoyam Specie 3 C3:** *Xanthosoma sagittifolium*

The higher phytate content in B3 and C3 suggests a greater potential for mineral-binding, which may necessitate phytate-reducing methods such as; Soaking (to reduces phytate content by up to 50%) Osagie *et al.*, (2021), Germination/ Sprouting (to enhances enzyme activity that breaks down phytates) Ukwuru and Egbon, (2018) and Fermentation (to significantly reduces phytate content while improving mineral bioavailability) Ene-Obong *et al.* (2017).

Despite its anti-nutritional effects, phytates exhibit health benefits such as protecting against colon cancer, reducing inflammation, and regulating blood sugar levels (Mensah *et al.,* 2022). Therefore, proper food processing techniques, such as soaking, sprouting, and fermentation, can help reduce phytate levels and enhance nutrient bioavailability. In summary, the findings highlight the need for appropriate processing methods to enhance the nutritional quality of these flours by reducing anti-nutritional factors while preserving their health benefits.

Conclusion

The proximate and phytochemical analysis of banana and cocoyam flours revealed significant variations in their nutritional composition. Banana flours are rich in carbohydrates, making them ideal for energy-dense diets, while cocoyam flours have higher protein, fiber, and mineral content, supporting balanced nutrition. However, anti-nutritional factors such as hydrogen cyanide, tannins, oxalates, and phytates were present, necessitating proper processing methods like soaking, fermentation, and cooking to enhance nutrient bioavailability and safety. Overall, both flours hold great potential for food applications, provided appropriate processing techniques are applied to maximize their nutritional benefits and minimize health risks.

Recommendations

Based on the findings of this study, we hereby propose the following recommendations:

i. **To improve on the processing techniques,** traditional processing methods such as **soaking, boiling, and fermentation** should be **applied** to reduce phytochemical factors like hydrogen cyanide, tannins, oxalates, and phytates while preserving the nutritional quality of the flours.

ii. Local food industries should adopt the utilization of banana and cocoyam flours in bakery products to **promote food diversification and reduce dependence on wheat flour.**

iii. Further studies should be done on the **storage stability, shelf life, and microbial safety** of banana and cocoyam flour-based products.

iv. More research should be conducted on **other functional properties** of these flours, such as their role in glycemic response and potential applications in gluten-free formulations.

Disclaimer of conflict of interest

We hereby declare that there are no conflicts of interest whatsoever in the nutritional profile data reported for the three varieties of Banana and cocoyam flour in this research work as it is only aimed towards contributing to academic knowledge and for future research reference.

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