

Phytochemical Compositions of Fruits of Three *Musa* Species at Three Stages of Development

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Abstract: This was designed to evaluate the phytochemical compositions of fruits of three *Musa* species at three stages of development. Spectrophotometric methods were used for the study. Results of the qualitative phytochemical assay of the pulp of the three *Musa* species harvested at different stages showed the presence of alkaloids, saponins, glycosides and flavonoids. Tannin was detected only in the ripe stage of plantain. Anthraquinones and phlobatannins were not detected in any of the samples at all the stages of development. The results of the quantitative phytochemical compositions of the three *Musa* species revealed that phenol content was highest in all the *Musa* species obtained at different levels of development followed by alkaloids. The quantity of tannins was observed to be high at the immature stages of development of the three *Musa* species. The quantity of each phytochemical in the different species was observed to have increased as fruit develops from immature to ripe stages. The results of the phytochemical compositions of the three *Musa* species at ripe stage show that the pulp of *Musa* species at the ripe stage contained phenols and saponins in abundance. Alkaloids and flavonoids were present in moderate quantities while tannin was absent in banana but present in plantain and saba banana, with a higher quantity in plantain. Phytochemical test is useful in the detection of bioactive principles and subsequently may lead to discoveries and development of the active ingredients so that they can be prevented from losing their potency. Most of these phytochemicals are present in the fruits at a concentration that may attract commercial exploitation.

Keywords: Phytochemical, Fruits, *Musa* species, Significant increase and Spectrophotometric

I. Introduction

Since the dawn of human civilization plants have made large contributions to facilitate human health and well being [1]. The stage of maturity of plants greatly affects the concentrations of nutrients in plants [2], thus it is very important to choose suitable stage of harvesting [3]. Medicinal potentials of most common plants have been extensively studied and compiled but the lack of information regarding the potential of these plants at varying stages of development makes these plants to be highly underutilized.

During the process of growth and development of fruit, series of developmental transitions are undergone. These processes involve coordinated changes in a number of catabolic and anabolic reactions [4], which leads to the synthesis or degradation of wide range of bioactive compounds. Hence, fruits at varying maturity levels may possess vivid bioactive compounds, which need to be studied so as to provide maturity indices for its usage as a source of food or medicine. It has also been proven that ethno-botanically derived compounds have potential bioactive compounds and they therefore provide greater potential for product development [5].

In Nigeria, fruits can be harvested at all stages of development (from immature to overripe) and can be used as a source of food in one form or the other. Some fruits are picked when they are mature but not yet ripe [6]. According to [7], plantain fruits may be consumed unripe (green), yellow-green, or ripe.

The stage of maturation at which any fruit is harvested also influences the fruit's green-life or its ability to be stored for long periods [7]. Fruits harvested at an early stage of maturity are of poor quality upon ripening, despite having a long storage life [8]. Similarly, harvesting at an advanced stage of maturity is unsuitable for fruits intended for long distance shipment due to their shorter storage life. However according to [9], the appropriate time to harvest unripe plantain for maximum benefit is between the 12th and 14th week. This two week period provides enough time for harvest, distribution, marketing and utilization of the produce before ripening.

Increased vegetable utilization and consumption are critical to alleviate world-wide incidence of nutritional deficiencies. Investigations have shown that some plants contribute to increased intake of some essential nutrients and health-promoting phytochemicals. Phytochemicals are present in virtually all of the fruits, vegetables, legumes (beans and peas), and grains we eat, so it is quite easy for most people to include them in their diet.

Musa paradisiaca L is an herbaceous plant (up to 9 m long) with a robust treelike pseudostem, a crown of large elongated oval deep-green leaves (up to 365 cm in length and 61 cm in width) with a prominent midrib. Each plant produces a single inflorescence like drooping spike, and large bracts opening in succession, ovate, 15-20 cm long, concave, dark red in color and somewhat fleshy. Fruits are oblong, fleshy, 5-7cm long in wild form and longer in the cultivated varieties. The ripe fruits are sweet and full of seeds and the peel is thicker than other banana. *Musa paradisiaca* is a type of plantain, which is normally cooked before it is eaten. It belongs to the AAB genomic group.

Musa sapientum L is a treelike perennial herb that grows 5 - 9 m in height, with tuberous rhizome, hard, long pseudostem. The inflorescence is big with a reddish brown bract and is eaten as vegetables. The banana plant grows up to 10 to 26 feet. *Musa sapientum* known as true banana or dessert banana is usually eaten raw at maturity. It belongs to the AAA genomic group.

Musa saba L is primarily a cooking banana although it can also be eaten raw. It is one of the most important banana varieties in Philippine cuisine. It is also known as the Cardaba banana or simply Saba banana. Saba bananas are part of the saba subgroup (ABB). Saba banana is a triploid (ABB) hybrid of the seeded banana *Musa balbisiana* and *Musa acuminata* [10]. It has predominant *Musa balbisiana* gene. It's also designated as *Musa acuminata* × *balbisiana* Colla (ABB Group) 'Saba'.

The fruits otherwise known as fingers are 8 to 13 cm long and 2.5 to 5.5 cm in diameter. Saba Bunches are big with 8 to 16 hands having 12 to 20 fingers per hand. The fruits are short and stubby and highly angular (plate 1b). Saba banana is a beautiful plant with an unusual bluish-green colored fruit. The pulp is white and starchy, making it ideal for cooking. The bright white interior contrasts with the outer peel. They are usually harvested while still green after about 150 to 180 days after planting [11]. The skin is thick and yellow when ripe (Plate 1c).

Saba banana has the largest and tallest stem attaining a height of four meters. It can grow to 25 feet and is very tolerant of cold and resistant to wind. The trunk can be as thick as 24 inches. Its leaves are dark green, and the banana is green skinned or green verging toward yellow. This plant is often grown for shade. The Saba plant's pseudo stem is robust and grows taller than the dessert cultivars, producing about 8 suckers per mat at harvest. Its fruit, however, has a longer gestation period at 150 to 180 days after flowering. The plant's potential yield is 26 to 28 kg per bunch with one bunch containing up to 16 hands, each hand having 12 to 20 fingers. In Nigeria, *Musa saba* is available year round in Southern part of the country but highly underutilized. It is highly restricted in utilization to production of flour and fried chips, thereby predisposing it to rapid post harvest spoilage contributed by its physiological metabolic activities and high moisture content. It is relatively cheaper as compared to dessert bananas and plantains and has been reported to be rich in minerals, ash and ascorbic acid [12].

Banana and plantain fruits can be used industrially in the production of baby food and pastries [13 and 14]. The peels of plantain can be dried and made into meal which can be used to substitute up to 70 – 80% of the grain in pig and dairy diets with little change in performance [15]. The meals are also used in poultry diets but when in high level tends to depress growth and reduces feed efficiency. The leaves, sheaths and petioles are used in tying, roofing, wrapping, and packaging of food. Plantain and banana are also used in beer production. In Central and East Africa, the juice from the ripe fruits is fermented to make beer with low alcohol content [15 and 16].

Akpabio *et al* (2012), [17], also observed that green plantain and banana pseudo stems can be used in alcohol production, paper making and in the preparation of cellulose derivatives. Unripe plantain because of its starch content indicates wider utility in alcohol production, fuel and sugar industries, and as drug binder in pharmaceuticals.

Plantain and banana play important role in income generation for both large scale and small holders' farmers in the country, especially for those who produce them within their homestead or gardens [18]. Plantains and bananas are known to contain bioactive compounds (phytochemicals) such as alkaloids, flavonoids, tannins and phenolic compounds [19 and 20]. According to [21], knowledge of the chemical composition of a plant together with its antioxidants activity will give a fair estimate of its therapeutic potential furthermore.

From the ongoing it is clear that knowledge of the constituents of any plant at each usable stage of development is necessary for better understanding of when it will be used to achieve desired result. Information about the stages of development of banana and plantain used to realize certain objectives in literature are scanty. Since these plantation crops can be utilized at different stages of development there is therefore an increased need to reveal the constituents at possible usable stages.

Phytochemicals are naturally occurring, biologically active chemical compounds in plants. In plants, phytochemicals act as a natural defense system for host plants and provide colour, aroma and flavour. Phytochemicals are a group of plant inherent bioactive substances that are responsible for protection of such plants from environmental stress, microbial attack, insects and other external aggression. These phytochemicals

are localized to fruit, seed, stem epidermis, flower and other peripheral surfaces of plants [22]. They can also be called secondary metabolites, and they include flavonoids, alkaloids, saponins, terpenoids, anthraquinone and carotenoids [23]. The therapeutic values of these secondary metabolites have been harnessed in the treatment and management of public health world over. One of the activities of this group of bioactive constituents is term antioxidant. The importance of antioxidant can be illustrated in the oxidation process phenomenon. Oxidation processes are inevitable in living system; however they are associated with production of free radicals. The free radicals are undesirable in food, drug and living system because they are linked with majority of human diseases notably, ageing, atherosclerosis, cancer, diabetics, liver cirrhosis, cardiovascular disorders etc. They are not essential nutrients and are not required by the human body for sustaining life [24].

II. Aims And Objectives

This was designed to evaluates the phytochemical compositions of fruits of three *Musa* species at three stages of development



Plate 1a : Fruits of Saba Banana { *Musa acuminata x balbisiana* Colla (ABB Group) cv saba} at the immature stage.



Plate 1b: Fruits of Saba Banana { *Musa acuminata x balbisiana* (ABB Group) cv saba } at green mature stage



Plate 1c: Fruits of Saba Banana { *Musa acuminata x balbisiana* (ABB Group) cv saba} at the ripe stage of development.



Plate 2a Fruits of plantain (*Musa paradisiaca* L) at the Immature Stage



Plate 2b Fruits of plantain (*Musa paradisiaca* L) at the green Mature Stage



Plate 2c Fruits of plantain (*Musa paradisiaca* L) at the Ripe Stage



Plate 3a Fruits of banana (*Musa sapientum* L) at the Immature Stage of Development



Plate 3b Fruits of banana (*Musa sapientum* L) at the green Mature Stage



Plate 3c Fruits of banana (*Musa sapientum* L) at the Ripe Stage of Development

III. Materials and Methods

Sources of Materials

Fresh plantain, banana and saba banana fruits used in this work were supplied through special arrangements with plantation farmers at Nike town in Enugu State Nigeria. The three *Musa* species used were *Musa paradisiaca* L, *Musa sapientum* L and *Musa saba* L. The species were identified and authenticated accordingly by Professor C. U. Okeke, a plant taxonomist of the Department of Botany Nnamdi Azikiwe University, Awka.

The fruits were collected fresh and used immediately in the analyses. The collection of the samples in these analyses was based on the rate of their development as recommended by [24]. Immature, green mature and ripe fruits were collected for the analyses (Plate 1^{a-c}, 2^{a-c} and 3^{a-c}). Fruits at each these stages of development were aged 30 – 45 days following fruit set for immature; 70 – 90 days of fruit set for green mature: while the ripe stage were those whose peels were showing 50% or more visible xanthophylls exposures or yellowing.

Sample Preparation

The samples were thoroughly washed under running water and the back removed exposing the pulp which was homogenized using a Kenwood warring blender and kept in the refrigerator until required for analysis.

Qualitative Phytochemical Analysis

The qualitative methods already established by [25 and 26], were used. The substances that were tested for included; alkaloids, Tannins, terpenoids, glycosides, flavonoids, Saponins and phenols.

Test for Alkaloids

The Mayer's, Dragendroff's, Wagner's, and Picric acid tests were used to test for alkaloids. One gram of the plant material was boiled for almost 2 minutes with 5ml of 2% hydrochloric acid in a steam bath and the material filtered. A volume 1ml portion of the filtrate was treated with 2 drops of the following reagents and for precipitate.

- (a) Mayer's reagent (potassium mercuric iodide solution)
- (b) Dragendroff's reagent (bismuth potassium iodide solution)
- (c) Wagner's reagent (iodide in potassium iodide solution)
- (d) 1% picric acid solution.

Turbidity or precipitate with either of the reagents was taken as evidence for the presence of alkaloids.

Test for Saponins

The Emulsion test and froth tests were used. The ability of saponins to produce emulsion with oil was used for the screening test. Twenty milligrams of sample was boiled in 20 ml of distilled water in a water bath for five minutes and filtered. Ten ml of the filtrate was mixed with 5 ml of distilled water and shaken vigorously for froth formation. Three drops of olive oil were mixed with froth, shaken vigorously and observed for emulsion development.

Test for Glycosides

Few drops of ferric chloride and concentrated sulphuric acid were added to a solution of the plant extract in glacial acetic acid. A reddish brown coloration at the junction of two layers and the bluish green colour in the upper layer indicated the presence of glycosides [27].

Test for Anthraquinones

Two hundred milligrams of the samples each was boiled with 6 ml of 1% HCl and filtered. The filtrate was shaken with 5 ml of benzene, filtered and 2 ml of 10% ammonia solution was added to the filtrate. The mixture was shaken and the presence of a pink, violet or red colour in the ammoniacal phase indicated the presence of free hydroxyl anthraquinones.

Test for Phlobatannins

Eighty milligrams of the samples each was boiled in 1% aqueous hydrochloric acid; the deposition of a red precipitate indicated the presence of phlobatannins.

Test for Flavonoids

Fifty milligrams of the samples each was suspended in 100 ml of distilled water to get the filtrate. Five milliliters of dilute ammonia solution was added to 10 ml of filtrate followed by few drops of concentrated H₂SO₄. Presence of flavonoids was confirmed by yellow colouration.

Test for Tannins

The test for tannin was carried out using the method described by [23]. 50 mg of the samples each was boiled in 20 ml of distilled water and filtered. A few drops of 0.1% FeCl₃ was added in filtrate and observed for colour change; brownish green or a blue-black colouration was taken as evidence for the presence of tannins.

IV. Quantitative Phytochemical Analysis

Saponin Determination

Saponin was determined using the method as described by [28]. Twenty grams of the sample was put into a conical flask and 100ml of 20% aqueous ethanol was added. The Sample was heated over a hot water bath for 4hrs with continuous stirring at about 55°C. The mixture was filtered and residue was again extracted with another 200ml of 20% ethanol. The combined extracts were reduced to 40ml over water bath at about 90°C. The Concentrate was transferred into a 250ml separating funnel and 20ml of diethyl ether was added and shaken vigorously. The aqueous layer (upper layer) was discarded and the purification process repeated. 60ml of n-butanol was added (discard the bottom and recover the upper layer). The combined n-butanol extracts were washed twice with 10ml of 5% aqueous sodium chloride. The remaining solution was heated in water bath. After evaporation, the samples were dried in the oven to dryness, a constant weight; the saponin content was calculated as percentage weight. The experiment was repeated on each of the samples.

% SAPONIN

CALCULATION

% Saponin = $(W_2 - W_1) / (\text{weight of sample}) \times 100/1$.

W₂ = weight of crucible + Sample after oven drying.

W₁ = weight of empty crucible

Weight of sample = 10g

Determination of Total Phenol

The phenolic content in the samples was estimated by Folin-Ciocalteu's colorimetric method described by [29], with some modifications. About 0.5 ml of each sample extract was mixed with 2.5 ml of distilled water. To this, 0.5 ml of Folin – Ciocalteu reagent (1:1) was added and incubated for 3 minutes.

To each tube, 2 ml of 20% Na₂CO₃ solution was added and the tubes were kept in boiling water bath for 1 minute. Tubes were cooled and the absorbance of reaction mixture was read at 650 nm. A standard curve was plotted using different concentrations of Gallic acid (standard, 0-1000 µg/ml).

Total phenolic content was expressed w/w and calculated using the formula

Total phenolic content (% w/w) = $(\text{GAE} \times V \times D \times 10^{-6} \times 100) / W$

GAE = Gallic Acid Equivalent (µg/ml)

V = Total Volume of Sample (ml)

D = Dilution Factor

W = Weight of sample (g)

Tannin Determination

Tannin was determined using the method as described by [30]. Half a gram (0.5) of the sample was weighed into 250ml conical flask and 50ml of distilled water added and then shaken on a rotating shaker (magnetic stirrer) for 1hr. The mixture was filtered into a 50ml volumetric flask. 5ml of the filtrate was pipetted into 50ml volumetric flask. (5ml of the filtrate was pipetted out into the test tube mixed with 2ml of 0.1M FeCl₃ in 0.1N HCl and 0.008M K₄Fe(CN)₆ (Potassium ferrocyanide). The absorbance was measured at 120nm within 10min) For the standard solution, 0.1g of tannic acid was dissolved in 100ml of water to form tannic acid solution. From the tannic acid solution 5ml was pipetted into another 50ml volumetric flask. A blank sample was prepared using 5ml distilled water.

The three prepared solutions were put in an incubator for 1hr 30mins at 20-30°C. After which the solutions were made up to the 50ml mark and absorbance of the solutions at 760nm were measured using Spectrophotometer.

Calculation:

Let absorbance of 5ml of extract be X

Let absorbance of tannic acid solution be Y

Let absorbance of Blank be Z

Tannin in mg/100 = $(X-Z)/(Y-Z)$.

Determination of Flavonoid Content

Total flavonoid content was determined following a method by [31]. In a 10 ml test tube, 0.3 ml of extract, 3.4 ml of 30% methanol, 0.15 ml of NaNO₂ (0.5 M) and 0.15 ml of AlCl₃.6H₂O (0.3 M) were mixed.

After 5 min, 1 ml of NaOH (1 M) was added. The solution was mixed well and the absorbance was measured against the reagent blank at 506 nm. The standard curve for total flavonoids was made using rutin standard solution (0 to 100 mg/l) under the same procedure as earlier described. The total flavonoids were expressed as milligrams of rutin equivalents per gram of dried fraction.

CALCULATION

$$\text{Flavonoid content} = (\text{RE} \times \text{V} \times \text{D} \times 10^{-6} \times 100) / \text{W}$$

RE = Rutin Equivalent ($\mu\text{g/ml}$)

V = Total volume of sample (ml)

D = Dilution factor

Determination of Alkaloids

Five grams of the plant sample was weighed into a 250ml beaker. 200ml of 10% HCL in ethanol was added and covered and allowed to stand for 4hrs. It was filtered and the extract concentrated on a water bath to one quarter of the original volume. Pigments and other unwanted materials were removed by shaking it with 100ml Chloroform in separating funnel. Distilled water was added. The lower layer was collected and excess ammonia added to precipitate the free alkaloid.

The whole solution was filtered through Whatman filter paper No 42 (125mm). The filtrate was later evaporated into dryness in an oven and weighed to a constant weight.

Calculation:

$$\% \text{ Alkaloids} = (\text{W}_2 - \text{W}_1) / (\text{weight of sample}) \times 100/1.$$

W_2 = weight of filter paper + Residue after oven drying.

W_1 = weight of filter paper

Weight of sample = 5g.

V. Results

Results of Qualitative Phytochemical Compositions of Fruits of Three *Musa* Species at Three Stages of Development

Results of the qualitative phytochemical assay of the pulp of the three *Musa* species harvested at different stages showed the presence of alkaloids, saponins, glycosides and flavonoid. Tannin was detected only in the ripe stage of plantain. Anthraquinones and phlobatannins were not detected in any of the samples at all the stages of development (Table 1)

Table 1: Qualitative Phytochemical Compositions of Fruits of Three *Musa* Species at Three Stages of Development

	Banana			Plantain			Saba Banana		
	R	GM	IM	R	GM	IM	R	GM	IM
Tannin	-	-	-	+	-	-	-	-	-
Flavonoid	+	+	+	+	+	+	-	-	-
Saponin	+	+	+	+	+	+	+	+	+
Glycoside	+	+	+	+	+	+	+	+	+
Anthroquinone	-	-	-	-	-	-	-	-	-
Phlobatanin	-	-	-	-	-	-	-	-	-
Alkaloid	+	+	+	+	+	+	+	+	+

+ =detected -= Not detected

R= Ripe stage GM= Green mature stage IM= Immature stage

Results of Quantitative Phytochemical Compositions of Fruits of Three *Musa* Species at Three Stages of Development

The results of the quantitative phytochemical compositions of the three *Musa* species showed that phenol content was highest in all the *Musa* species obtained at different levels of development followed by alkaloids. The quantity of tannins was observed to be high at the immature stages of development of the three *Musa* species. The quantity of each phytochemical in the different species was observed to have increased as fruit develops from immature to ripe stages (Table 4.5). Differences in Alkaloid content among the stages of development with respect to each fruit species were significant by Duncan’s multiple range tests. Prominently, the saponin constituent of saba banana and banana at ripe stages were high, the difference between them were significant using Duncans multiple range tests.

Table 2: Quantitative Phytochemical Compositions of fruits of Three *Musa* Species at Three Stages of Development

Phytochemical components		Phytochemical Compositions %		
		Banana	Plantain	Saba Banana
Alkaloid	Immature	0.251 ± 0.003 ^f	0.643 ± 0.003 ^e	0.860 ± 0.005 ^b
	Green mature	0.770 ± 0.002 ^{cd}	0.187 ± 0.001 ^f	0.736 ± 0.004 ^d
	Ripe	0.778 ± 0.006 ^{bc}	1.027 ± 0.003 ^a	0.083 ± 0.001 ^g
Saponin	Immature	0.145 ± 0.005 ⁱ	0.773 ± 0.003 ^f	0.365 ± 0.000 ^j
	Green mature	1.175 ± 0.005 ^c	0.858 ± 0.003 ^e	0.179 ± 0.000 ^h
	Ripe	2.268 ± 0.003 ^b	0.973 ± 0.033 ^d	2.573 ± 0.003 ^a
Phenol	Immature	3.115 ± 0.005 ^c	2.498 ± 0.003 ^f	2.289 ± 0.001 ^h
	Green mature	3.310 ± 0.010 ^b	2.448 ± 0.003 ^e	3.392 ± 0.004 ^a
	Ripe	2.545 ± 0.005 ^c	2.697 ± 0.003 ^d	2.241 ± 0.016 ⁱ
Tannin	Immature	2.180 ± 0.462 ^a	ND	1.223 ± 0.049 ^b
	Green mature	1.138 ± 0.151 ^c	ND	ND
	Ripe	ND	2.360 ± 0.215 ^a	1.009 ± 0.151 ^c
Flavonoid	Immature	0.468 ± 0.002 ^b	0.114 ± 0.001 ^e	0.247 ± 0.004 ^f
	Green mature	0.444 ± 0.006 ^c	1.113 ± 0.001 ^a	0.330 ± 0.002 ^d
	Ripe	0.071 ± 0.000 ^h	0.467 ± 0.001 ^b	0.292 ± 0.003 ^e

Results are in Means ± Standard Error. Means ± Standard Error followed by the same letter(s) in a column are not significant

Results of Phytochemical compositions of three *Musa* species at Ripe Stage of Development

The results of the phytochemical compositions of the three *Musa* species at ripe stage show that the pulp of *Musa* species at the ripe stage contained phenols and saponin in abundance. Alkaloids and flavonoids, were present in moderate quantities while tannin was absent in banana but present in plantain and saba banana, with a higher quantity in plantain (Fig 1).

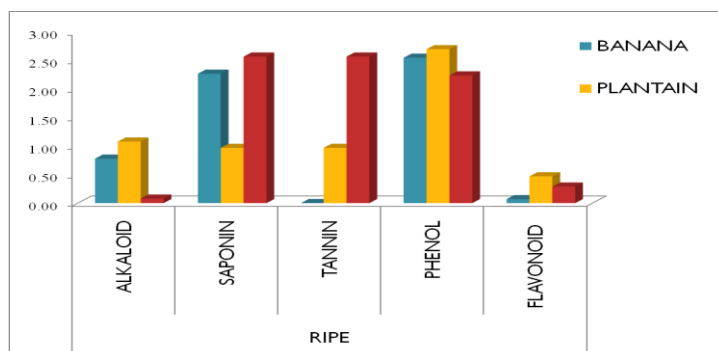


Fig 1: Phytochemical compositions of three *Musa* species at ripe stage of development

Results of Phytochemical compositions of three *Musa* species at green Mature Stage of Development

The results of the comparative phytochemical assay of the three *Musa* species showed that at the green mature stage, the phytochemicals present include phenols which were present in abundance. Flavonoid content of plantain was higher than in banana and saba banana. Alkaloids and flavonoids were present in moderate quantities while Tannin contents of the samples increased in banana and saba banana but was absent in plantain (Fig 2).

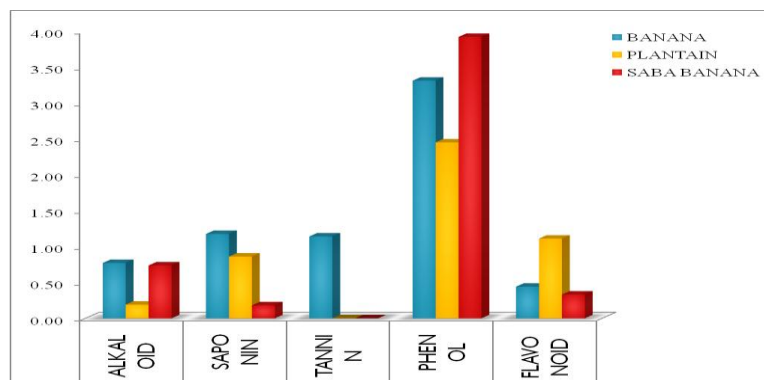


Fig 2 Phytochemical compositions of three *Musa* species at green Mature Stage of Development

Results of Phytochemical compositions of three *Musa* species at Immature Stage of Development

At immature stages, alkaloid, phenol and glycoside contents of saba banana were higher than as compared to banana and plantain (Fig 3). Tannin was not detected in saba banana and plantain. There was an increase in the tannin content of banana than as it was at the green mature stage (Table 2)

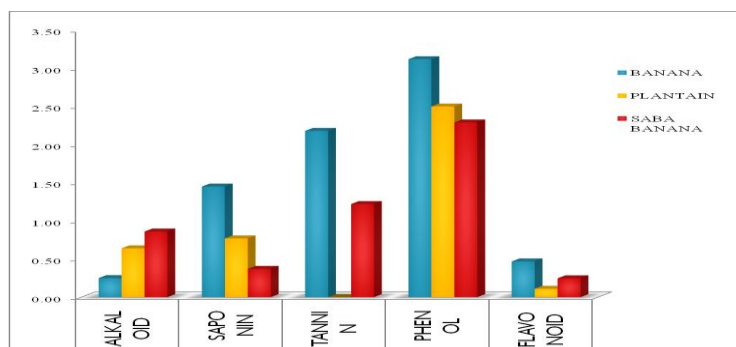


Fig 3: Phytochemical compositions of three *Musa* species at Immature Stage of Development

VI. Discussion

The Phytochemical assay revealed the presence of some phytochemicals like phenols, tannins, alkaloids, saponins, flavonoids and glycosides at varying concentrations. The presence of these phytochemicals confirms the three *Musa* species tested to be of medicinal value. This agrees with so many reports in the literature on their medicinal uses [32, 33 and 34]. Phytochemicals are non nutritive plant chemicals that have protective or disease preventive properties. Phenols in the three *Musa* species revealed no significant difference between them but rather between their stages of development. The phenol contents of the fruits were higher at the immature and green mature stages than at the ripe stages. This implies that the fruits at the immature and green mature stage are rich source of antioxidants because studies have shown that antioxidants capacity of plants is tightly correlated with phenol compounds [35 and 36]. Phenol is a major active ingredient in antiseptics and disinfectants due to their antimicrobial activity. Phenols are also strong antioxidants that prevent oxidative diseases such as cancer and cardiovascular diseases. The plant phenols may interfere with all stages of the cancer processes, potentially resulting in a reduction of cancer risk [37]. The phenol compounds present in plants are also responsible for their contribution to colour, sensory and antioxidant properties of food [38 and 16]. There was no significant difference in flavonoids contents between the three different species but rather a slight difference was observed in the stages of development. Flavonoids are naturally occurring phenols. They are thought to have positive effects on human health. Studies have shown that flavonoids possess antibacterial, antiviral, anti-inflammatory, anticancer and anti allergic abilities [39 and 40]. Flavonoids have been shown to be highly effective scavengers of most oxidizing molecules. It has the ability to scavenge hydroxyl radicals, super oxide anions and lipid peroxy radicals [25]. The decreasing trends in scavenging activity of plants with respect to crop maturity were attributed to phenols reduction at maturity [41].

Alkaloids content between the three species revealed no significant difference. Alkaloids are the most therapeutic plant substance. They are used as basic medicinal agents because of their analgesic, antiplasmodic and antibacterial properties [42].

Alkaloids are nitrogen containing naturally occurring compounds found to have antimicrobial properties due to their ability to intercolate with DNA of the micro organisms [43]. Significant difference was only observed at the stages of development. The alkaloid content of the fruits increased with ripening or development.

The quantitative analysis revealed the presence of tannin at some stages. Tannin was observed at the immature stages of banana (2.180 ± 0.462) and saba banana (1.223 ± 0.049). At the green mature stages tannin was observed in banana (1.138 ± 1.151) but was not detected in plantain and Saba banana respectively. Although it was observed in the ripe stages of plantain and Saba banana it wasn't observed at the ripe stage of banana.

The presence of tannin shows that the fruit has astringent properties, quicken the healing of wounds and inflamed mucous membrane. Tannins can also be effective in curbing hemorrhages as well as restrict swelling [43]. They are also beneficial as mouthwashes, eyewashes, snuff and even as vaginal douches [44 and 45]. Long term use of tannin containing plants is not recommended as tannin when applied internally, sour the mucus secretions, contract the membranes in such a manner that secretions from the cells are restricted [46, 47 and 48]. The quantity of tannins observed revealed no significant difference between the fruits of the three species of *Musa*.

VII. Conclusion

Phytochemical test is useful in the detection of bioactive principles and subsequently may lead to discoveries and development of the active ingredients so that they can be prevented from losing their potency and in general, most of these phytochemicals are present in the fruits at a concentration that may attract commercial exploitation.

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