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Physiochemical Analysis of Five Varieties of Banana Commonly Consumed in Nigeria

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Abstract – **There is direct correlation between consumption of plant foods and occurrence of chronic degenerative diseases, one of such plants is *Musa* species. In this research work, five varieties of banana commonly consumed in Nigeria were evaluated for proximate, mineral compositions and antioxidant capacities using standard analytical techniques. Results revealed that varieties of banana namely; baby/nino, *burro*, red, monzano and cavendish were low in crude protein, fat and fibre but, they were significantly high in K, Mg and P. Also, the carbohydrates and dietary energy were of high values. Antioxidant activity (AA) and Total phenolic content (TPC) of the aqueous extracts of the samples ranged from 0.67-4.84 and 1.21-2.55mg/ 100g respectively. This indicates that the five varieties commonly consumed by adults and children as food and food adjuncts can possibly be utilized as sources of vital minerals and possible scavengers of free radicals thereby preventing the symptoms that are associated with degenerative diseases.**

Keywords – **Antioxidant Activity, Banana, Diseases Nutrients.**

I. Introduction

The effect of rapidly growing urbanization is incessant generation of pollutants to the environment. This has caused increase in the interaction of human with free radicals reported to be associated with incidence of chronic diseases [1]. The consumption of plant food as major sources of natural antioxidants has been effective mopping agent for free radicals [2]. The food consumed by human has a direct effect on their wellbeing. Public agencies and agricultural industries use nutritional information to promote fresh produce, while consumers on the other end are looking for variety of diets and are aware of the benefits of consuming fresh foods. This is due to the awareness created on the importance of people to consume diet rich in antioxidants and other minerals vital for human health. Plant foods form a major part of Nigerian diet, one of such is banana, the most important tropical fruit in the world [3]. Bananas and plantains are the fourth most important food crop in the world after rice, wheat, and maize [3]. They also constitute a major staple food crop for millions of people in developing countries. Banana is a perennial crop with a short gestation period, making it very easy to cultivate.

Bananas are consumed as fruits, it may also be processed to other forms like smoothies, banana pan cake, plantain porridge, ice cream, yoghurt, cake, bread, nectar and baby food. At times, it is canned with syrup and used in bakery products, fruits salads and toppings [4]. It is known for its energy-boosting effect and its richness in vitamin C which makes it a very good antioxidant source. The antioxidant capacity of bananas is reported to be attributed to their gallocatechin content [5]. They contain several essential nutrients and provide benefits for digestion, heart health and weight loss. Aside from being very nutritious, they are also a highly convenient snack food. Banana is believed to promote wound healing, especially burns and prevention of substantial number of illness such as depression can be achieved by consuming banana [6]. The biological activity of banana is directly related to their chemical composition [7], for instance, the antioxidant activity is attributed to their phenolic constituents [8]. It was found that higher content of polyphenols, flavonoids, total dietary fibre, insoluble dietary fibre, lignin, hemicellulose, cellulose, antioxidant capacity, and free-radical scavenging capacity was present in banana pulp [9]. Banana peel is also rich in many high-value health-promoting antioxidant phytochemicals, such as anthocyanins, delphinidin, cyanidins and a rich source of total phenolic compound which are responsible for the very high antioxidant activity [10, 11]. The antioxidant activity of banana is high and could be used to fight some diseases in the human body [12].

Furthermore, banana are low on the glycaemic index and releases their energy into the blood stream slowly, according to the International glycaemic index (GI) database, fully ripe bananas has a GI of 51 which counts as low GI food because the value is less than 55. The chemical composition of banana peel and pulp comprises mostly of carotenoids, phenolic compounds and biogenic amines.

This research is set to investigate the varieties of banana cultivars planted in large quantity in certain parts of South West Nigeria, especially Ekiti State and commonly consumed as food and food adjuncts.

II. Methodology

A. *Source of Sample*

Five varieties of *Musa* species were obtained from a local market at Ilawe Ekiti, a town with a predominance of banana plantation and market in Ekiti State, Nigeria. All samples were properly washed; wet weighed and subsequently blended in preparation for various analyses.

B. *Chemical Composition Analysis*

The proximate compositions of the banana samples were according to methods described by Pearson [13]. Total protein content was determined by a semi-micro Kjeldahl method according to AOAC procedure 2005, and the percentage nitrogen converted to crude protein by multiplying by 6.25 [14]. The minerals were analysed after

first dry-ashing at 550°C in a Muffle furnace and dissolved in deionised water to standard volume. Mg, Ca, Zn, Mn, Fe and Cu were determined using an atomic absorption spectrophotometer [15]. Sodium and potassium were determined by flame photometry and phosphorus by the AOAC's Vanado-molybdate method. The gross energy content of the different samples were estimated from the proximate constituents as described by Ng and Wee [16].

C. *Total Antioxidant Capacity (TAC) and Total Phenolic Content (TPC) Assays*

Both TAC and TPC in the banana samples were measured using spectrophotometric assays on a UV–visible spectrophotometer. TAC was determined using the Ferric-ion-Reducing Antioxidant Potential (FRAP) assay method of Benzie and Strain [17]. Total phenolic content (TPC) was determined according to the method of Singleton [18]. Analysis for each sample was determined in triplicates and their mean values expressed as Gallic Acid Equivalent (GAE/g).

D. *Statistical Analysis*

All determinations were carried out in triplicates. The results generated from the analysis were subjected to statistical analysis using the Statistical Package for Social Science (SPSS) Version 16. Descriptive statistics was used to interpret the results obtained.

III. Results and Discussion

The proximate composition of the varieties of banana was presented as in Table 1. The moisture contents ranged from 69.49-71.11% with burro banana having the highest value of 71.11. This value is significantly higher than the value reported by Adeolu and Enesi [19]. The high moisture content suggests that the variety is predisposed to microbial spoilage, deterioration and short shelf life, this makes it scarce.

The fibre content is significantly low, with baby banana having the lowest (0.01%), and the highest value was (0.48%) which can be found in burro banana. The fat content of five varieties was very low ranging from (0.08-0.52%). This suggests that all the varieties may not be good source of fat soluble vitamins. The crude protein and total ash content in the five varieties ranged from (1.25-2.35%) and (0.85-0.94%) respectively.

Carbohydrates serve as fuel for the body being the major energy source was high in all the varieties tested with the values relatively the same (26.61, 26.77, 26.12 27.69 and 26.72%). This correlates with the results earlier reported by Egbebi [12]. The result indicates that all the varieties are good sources of energy.

Table II presents the mineral composition of the five varieties; K, Mg, and P were significantly high in all samples and Na, Ca, Zn was present at various levels. These results are comparable with the values reported by various authors [20, 21 22, and 23] The potassium content of banana makes it beneficial for maintaining healthy kidney. Its mineral content also makes its very useful in maintaining a healthy heart, because according to FDA, the high potassium and low sodium content may help protect the cardiovascular system against high blood pressure. The Na-K and Ca-P ratios are less than one indicating that all varieties tested can be possibly used in formulating diets for hypertensive patients and for utilized proper bone development. It is also rich in calcium and phosphorus which are very important in the formation of strong bones and teeth, for growth, normal nerve and muscle action, blood clotting, maintenance of heart function and cell membrane [24].

The antioxidant activities of the five varieties were high but the fifth sample (monzano banana) had the highest, which implies that they can be used as major source of dietary antioxidants required for scavenging free radicals generated by essential metabolic reactions in humans and

Table 1. Proximate Composition of five varieties of Banana species.

S/NO	MC	CP	ASH	FAT	FIBRE	CHO	ENERGY (Kg/100g)
1	69.49 ± 0.01	2.35 ± 0.03	0.93 ± 0.02	0.52 ± 0.01	0.01 ± 0.02	26.61 ± 0.04	482.02
2	70.29 ± 0.02	1.37 ± 0.03	0.94 ± 0.03	0.23 ± 0.02	0.40 ± 0.02	26.77 ± 0.05	473.13
3	71.11 ± 0.31	1.25 ± 0.02	0.85 ± 0.02	0.08 ± 0.02	0.48 ± 0.02	26.12 ± 0.34	**459.59**
4	69.65 ± 0.02	1.30 ± 0.01	0.86 ± 0.02	0.42 ± 0.01	0.08 ± 0.02	27.69 ± 0.03	**508.59**
5	70.40 ± 0.02	1.31 ± 0.02	0.88 ± 0.02	0.21 ± 0.02	0.47 ± 0.01	26.72 ± 0.01	465.59

Values are means of triplicate determination.

Table 2. Mineral composition five varieties of Banana (Musa spp) in mg/100g.

MINERALS	Na	K	Ca	Mg	Zn	Fe	Mn	Cu	P	Na/K	Ca/P
1	1.21 ± 0.02	45.37 ± 0.01	8.68 ± 0.01	50.33 ± 0.03	2.33 ± 0.04	1.43 ± 0.01	0.02 ± 0.01	ND	40.38 ± 0.01	0.03	0.21
2	0.98 ±0.02	40.84 ± 0.23	8.39 ± 0.04	49.07 ± 0.03	1.86 ± 0.02	0.91 ± 0.01	0.02 ± 0.00	ND	30.66 ± 0.02	0.02	0.27
3	1.04 ± 0.01	42.52 ± 0.01	7.26 ± 0.01	51.34 ± 0.02	2.44 ± 0.02	0.94 ± 0.01	0.11 ± 0.00	ND	33.56 ± 0.02	0.02	0.22
4	1.17 ± 0.02	42.69 ± 0.02	7.39 ± 0.01	51.40 ± 0.00	2.32 ± 0.02	0.69 ± 0.00	0.08 ± 0.00	ND	40.40 ± 0.02	0.03	0.18
5	1.09 ± 0.01	43.36 ± 0.01	8.43 ± 0.00	50.29 ± 0.01	1.84 ± 0.01	0.70 ± 0.01	0.13 ± 0.01	ND	34.30 ± 0.02	0.03	0.25

1-Baby banana; **2**-Red banana; **3**-burro banana; **4**-Cavendish banana; **5**-Monzano banana; **ND**-Not Determined
Values are means of triplicate determination

environmental pollutions. Food with high antioxidant activities are known to protect the body from the harmful substances that can result in ill health, development of cancerous cell and other cardiovascular diseases.

The total phenolic content ranges from (1.21-2.55mg/ 100g). The phenolics present in banana fruit are the major bioactive compounds having antioxidant properties, this major phenolics present in banana have been identified as gallic acid, catechin, epicatechin, tannins and anthocyanins [25]. The results show that monzano had high phenolic content (2.55mg/100g) which was significantly higher than the other four varieties, this relates well with the result reported by other authors. The phenolics were responsible for the high antioxidant activity, which agrees with results from previous reports [11, 26, and 27].

Table 3. Antioxidant activity of five varieties of Banana.

S/NO	CON1	CON2	CON3	mg/100g	mg/100g	mg/100g	MEAN
1	371.56	372.44	372.44	1.86	1.86	1.86	1.86
2	153.78	154.64	153.78	0.77	0.77	0.77	0.77
3	163.56	162.67	163.56	0.81	0.81	0.82	0.81
4	135.11	134.22	134.22	0.68	0.67	0.67	0.67
5	964.44	968	969.78	4.82	4.84	4.85	**4.84**

Table 4. Total Phenolic Content of Banana Varieties.

S/NO	CON 1	CON 2	C0N3	mg/100g	mg/100g	mg/100g	MEAN
1	281.43	282.65	280.38	1.41	1.41	1.4	1.41
2	242.43	243.16	242.03	1.21	1.22	1.21	1.21
3	312.08	309.49	314.92	1.56	1.55	1.57	1.56
4	**345.73**	345.49	345.73	1.73	1.73	1.73	1.73
5	**510**	509.19	508.78	2.55	2.54	2.55	**2.55**

IV. Conclusion

The five varieties of banana tested were good sources of carbohydrate; also, the mineral analysis reveals that they are very rich in potassium, magnesium, phospho- -rus and calcium. Furthermore, this recent study highlighted that the five varieties of banana serve as major sources of natural dietary antioxidant due to presence of phytochemicals with red banana exhibiting higher potential in comparison to other four varieties under investigation.

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