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PHYTOCHEMICAL, VITAMIN COMPOSITIONS AND ANTIOXIDANT POTENTIAL OF *Kigelia africana* FRUIT AND LEAF MEALS

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This experiment was conducted to investigate the chemical composition of *Kigelia africana* (KA) fruit and leaf meals where the qualitative and quantitative phytochemicals, antioxidant potentials, and vitamins compositions of both samples were compared. The most available phytochemical in both fruit and leaf was flavonoid and was significantly ($p<0.05$) higher in the fruit. The free radical scavenging activity conducted by spectro-photometric assay on the reduction of 1,1-diphenyl-2-picrylhydrazyl (DPPH), and total antioxidant potential (TAP) assay were both compared with a standard, ascorbic acid. The antioxidant potentials (DPPH and TAP) of both fruit and leaf were significantly ($p<0.05$) higher than that of the standard. The vitamins, except vitamin E were significantly ($p<0.05$) higher in the fruit. In conclusion, *Kigelia africana* fruit is richer in flavonoid, some vitamins compared with the leaf and this can explain it great antioxidant potentials recorded in this trial. However, based on the nutritional composition and antioxidant potentials of this plant parts, they can both be included in rabbit and ruminant diet to boost productivity, solve some health conditions and at the same time solve the environmental problems that the fruit of this tree usually constitute in areas where the tree is abundant.

Keywords: *Kigelia africana*; fruit; leaf; phytochemicals; antioxidant.

1. INTRODUCTION

Kigelia africana tree belongs to the family Bignoniaceae. They are commonly called Sausage tree or Cucumber tree due to its long sausage-like fruit. It grows commonly in tropical west, east and central African regions particularly in low plains in Nigeria. Its fruits weighs between 4 - 10 kg which hangs from a long fibrous stalk, it can be found in open woodland [2]. The tree is widely grown as an ornamental plant for its decorative flowers and unusual fruit [2]. In folklore, the fruit of *Kigelia africana* represents a symbol of fertility [3], the fruits and flowers are usually mixed with alcohol or water by traditional healers for treatment of fertility related problems among women and men of child bearing age [4]. All the functional properties attributed to *Kigelia africana* plant that makes it seems to be suitable for treatment of many diseases have been associated with the presence of numerous phytochemicals such as flavonoids, naphthoquinones, tannins, steroids and so on [5,6]. The combined effects of these phytochemical compounds in this plant makes such plant to possess many functional properties such as being an antioxidant, anti-inflammatory, antiseptic, antibacterial, antifungal and so on. Varieties of plants

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have been identified to possess these properties and when applied in animal diets, can maintain and also improve the reproductive as well as general health status of the animals. This study was however carried out to investigate some of these bioactive components of *Kigelia africana* fruit and leaf in order to validate their application in animal production.

2. MATERIALS AND METHODS

2.1 Source and Preparation of *Kigelia africana* Meals

The *Kigelia africana* fruit and leaves were collected from Ilorin metropolis. The fruits and the leaves of the plant were air-dried and milled in to fine particles. The milled samples were taken to the laboratory for analysis. The chemical analyses were conducted at the central research laboratory, Tanke, Ilorin. The samples were replicated in three places. The phytochemical screening of the samples was determined using the method described by Makkar [7]. Quantification of the available phytochemical contents was determined using the methods described by Ganapaty (2013). Antioxidant activities were determined using the methods described by Larrauri et al., (1999) and [8]. Various vitamins (vitamins C, A, E and B) were determined as described by A.O.A.C [9].

2.2 Statistical Analysis

All data obtained were subjected to a T-test using SAS 9.4, 2012.

3. RESULTS AND DISCUSSION

The results of the evaluated vitamins in the fruit and leaf of *Kigelia africana* are presented in Table 1. There were significant differences ($p<0.05$) among the evaluated vitamins. The Vitamin C content of the fruit was significantly higher ($p<0.05$) than that of the leaf. Similarly, the folic acid (vitamin B9) content of the fruit was higher than that in the leaf. The mean values of Vitamin A and E present in the leaf are however significantly ($p<0.05$) higher compared with that present in the fruit. Both fruit and the leaf of KA have reasonable contents of vitamins A, B9, C and E. Vitamin A helps in maintaining healthy vision, skin, and mucous membrane as well as promoting bone and tooth growth making their inclusion in animal diet a necessity to achieve a maximum productivity. Vitamin C and E are known for their anti-oxidant properties [10], helps in boosting the immune system, the effects of which could be seen in the improved general health and reproductive performance of the animals, Mangiagalli et al. [11]. It has been established that anti-oxidant promotes male fertility by reducing oxidative stress, scavenging free radicals and promoting general health [12]. The vitamin E contents of both the fruit and the leaf obtained from this work is higher than what was obtained from the seed of same plant by Elinton et al., [13].

The results obtained from the qualitative and quantitative phytochemical analysis conducted on *Kigelia africana* fruit and leaf meals are presented in Table 2. The results from the analysis showed the presence of flavonoids, steroids, phytate, oxalate, saponin, tannin, phenolics, and alkaloids. Terpenoids and cardiac glycoside were however not present in both fruit and the leaf. Steroids, phytate, oxalate, phenolic, and alkaloids were equally available in the leaf and the fruit of the plant. However, flavonoids and tannin were more available in the fruit than in the leaf. There was a significant difference ($P<0.05$) between the flavonoids, steroids, oxalate, tannin and phenolic contents of the fruit and leaf with fruit having a higher mean values. Among all the phytochemicals, flavonoid is the most available in both fruit and leaf with highest mean recorded in the fruit. There was no significant difference ($P>0.05$) between the values obtained in Phytate and Saponin contents of fruit and leaf. Flavonoids, phenol and tannin were significantly ($p<0.05$) higher in the fruit while the leaf was high in steroids and alkaloids.

Table 1. Quantitative analysis of selected vitamins in *Kigelia africana* fruit and leaf meals

Parameters	KAF	KAL	(P<0.05)
vitamin C (mg/100g)	32.72 ± 2.49^{a}	20.83 ± 0.29^{b}	0.001
A (µg/100g)	2.36 ± 0.01^{b}	4.38 ± 0.023^{a}	0.0002
E (µg/100g)	2.10 ± 0.21^{b}	4.45 ± 0.22^{a}	0.025
B9 (µg/100g)	121.39 ± 0.21^{a}	120.17 ± 0.22^{b}	0.020

**KAF= Kigelia africana fruit, KAL= Kigelia africana leaf, a, b, c – means with different superscript are significant along the row*

Table 2. **Quantitative phytochemical analysis of *Kigelia africana* fruit and leave meals**

Parameters	KAF	KAF (mg/100g)	KAL	KAL (mg/100g)	(P<0.05)
Flavonoids	+++	29.92±0.47[a]	++	4.63± 0.14[b]	0.016
Steroids	+	0.19±0.00[b]	+	0.20±0.00[a]	0.0001
Phytate	++	0.49±0.14	++	0.74±0.29	0.24
Oxalate	+	0.22±0.08[a]	+	0.14±0.01[b]	0.01
Saponin	++	0.47±0.29	++	0.29±0.04	0.33
Tannin	++	0.51±0.39[a]	+	0.03±0.00[b]	0.001
Phenolic	+	0.04±0.01[a]	+	0.02±0.00[b]	0.01
Alkaloids	+	0.04±0.00[b]	+	0.30±0.26[a]	0.0001
Terpenoid	-	-	-	-	-
Cardiac glycoside	-	-	-	-	-

**KAF= Kigelia africana fruit, KAL= Kigelia africana leaf a, b, c – means with different superscript are significant along the row, +++= highly available, ++= moderately available, += present, - = absent*

Table 3. Anti-oxidant activities of *Kigelia africana* fruit and leaf meals

DPPH conc	KAF	KAL	Vit C	(P<0.05)
10	131.05±1.82 [a]	99.08±3.35[b]	73.497	0.001
20	135.45±2.47 [a]	108.68±1.44[b]	79.018	0.001
30	135.18±1.75 [a]	118.23±1.56[b]	83.067	0.002
40	136.80±2.26 [a]	123.45±2.25[b]	87.485	0.014
50	134.75±3.38	128.39±0.22	89.571	0.134
TAP	2320.1±32.35[a]	2020.7±44.93[b]	-	0.001

**KAF= Kigelia africana fruit, KAL= Kigelia africana leaf, TAP= total anti-oxidant potential, DPPH=2, 2-diphenyl-1-picrylhydrazyl, Vit= Vitamin a, b, c – means with different superscript are significant along the row*

The results of the DPPH (2, 2-diphenyl-1-picrylhydrazyl) antioxidant activity and total antioxidant potentials (TAP) of *Kigelia africana* fruit and leaf are presented in Table 3. There was a significant difference (P<0.05) in the values obtained for DPPH antioxidant test in the fruit and leaf, with fruit reporting a significantly (p<0.05) higher mean values at all DPPH concentrations except at 50 where there was no difference between fruit and leaf. However, the mean DPPH antioxidant values of fruit and leaf were higher when compared with the standard vitamin (ascorbic acid). More so, the fruit presented a higher TAP compared with that of the leaf. It was revealed from the present study that the fruit of *Kigelia africana* can be regarded as a potential anti-oxidant based on the results of total anti-oxidant potential and DPPH anti-oxidant test in which fruit showed a better result compared with the leaf. However, both fruit and leaf had better antioxidant properties than the conventional source (ascorbic acid). This anti-oxidant potential of KA can be attributed to the numerous phytochemicals present in it, especially flavonoid which was most available among other phytochemicals in both the fruit and the leaf. Recently, flavonoids have been considered as great antioxidants and proven to be more effective than Vitamin C and E [14]. They are known to scavenge or prevent the production of free radicals and reactive oxygen species, which are the major cause of oxidative stress related diseases. Flavonoids inhibit oxidation through a variety of mechanisms and their protective effects in biological systems are ascribed to their capacity to transfer free radical electrons [15].

4. CONCLUSION

The results showed that *Kigelia africana* fruit and leaf are rich source of important vitamins, phytochemicals which in turn make them a very good sources of antioxidants capable of improving growth, health and reproductive performance of animals. they can both serve as additive or supplements in animal feed.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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