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Verification of the folkloric antipyretic claim of the aqueous and ethanolic extracts of *Kigelia africana* Lam. (Benth.)

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Abstract

The bark of *Kigelia africana* Lam. (Benth.) as powder or infusion is used in ethnomedicine for the treatment of ulcers, or applied in treatment of pneumonia and malaria. Hence the aqueous and ethanolic extracts of *Kigelia africana* were investigated for antipyretic activity in albino rabbits. Pyrexia was induced by *Escherichia coli*, at a dose of 10^6cfu /ml. *Escherichia coli* was injected intravenously *via* the marginal ear vein, at a dose of 1ml/ 5kg body weight of the rabbits. An hour later the extracts, aqueous and ethanolic (500mg/kg & 1000mg/kg respectively) were given *via* the oral route. The ethanolic extract showed marked antipyretic activity based on the reduction of pyrogen-induced fever in rabbits ($P<0.05$). This effect at 500mg/kg was 98% of that produced by aspirin. However the effect of the aqueous extract was not statistically significant at both doses tested. Thus the ethanolic extract possesses antipyretic activity. This study therefore supports its use in ethnomedicine as an antipyretic agent

Keywords: *Kigelia africana*; Antipyretic activity; *E. coli*

Introduction

Kigelia africana. (Lam). Benth. (Family: Bignoniaceae) is a plant that is widely distributed in South, Central and West Africa. Locally known by Europeans as the Cucumber or Sausage tree because of the huge fruits (average 0.6m in length and 4kg in weight), which hangs from long fibrous stalks. The tree can grow to more than 20 metres tall. It is found mostly in riverine areas. Its distribution is restricted to the wetter areas. Different parts of this plant have been claimed to serve various purposes in different parts of the world. (van Wyk *et al.*, 1997).

Traditional healers have used the sausage tree to treat a wide range of skin ailments from relatively mild complaints such as fungal infections, boils, psoriasis and eczema, through to the more serious diseases like leprosy, syphilis and skin cancer (Joffe, 2001). Venereal diseases are commonly treated with the extracts usually in palm wine as oral medication. The fruit and bark, ground and boiled in water, are also taken orally or used as enema in treating stomach ailments. The Shona people of Southern Africa use the bark as powder or infusion for application to ulcers, or applied in treatment of pneumonia and malaria (Pooley, 1993).

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Previous studies of the fruits of *Kigelia africana* showed some antibacterial activity (Grace *et al.*, 2001). However there is no report on the antipyretic properties of the bark of this plant. This paper therefore presents studies on the antipyretic activity of the ethanolic and aqueous extracts of the bark of *Kigelia africana*.

Experimental

Plant material. The bark of *Kigelia africana* was collected, based on ethnopharmacological information, in Okomu forest reserve, Udo in Benin City, Edo State. The plant and its bark were authenticated at the Forestry Research Institute of Nigeria (FRIN), Ibadan, Nigeria, by Comparison with a herbarium samples. A herbarium specimen No FHI 107654 was deposited there for future reference. Immediately after collection, the bark was cut into small pieces and dried under sunlight. The dried pieces of bark were pulverized into a smooth powder using impact mill, weighed and kept for further analysis.

Extraction and phytochemical screening. The powdered material was mixed with absolute ethanol and left for 72 hours. The mixture was stirred at six-hour intervals using a sterile glass rod, while another sample of plant material was put into 4 litres of distilled water and heated using a hot plate for 30minutes. At the end, both extracts were passed through filter paper. The filtrates were concentrated *in vacuo* at (40^0C). The products were stored in universal bottles and refrigerated at 4^0 C prior to use. Qualitative tests for the presence of plant secondary metabolites such as alkaloids, tannins, flavonoids, saponins and glycosides were carried out on the powdered bark using standard procedures (Sofowora, 1984).

Animals. Albino rabbits (1.03 – 1.95kg) of either sexes kept at the laboratory animal house of the Department of Pharmacology, Faculty of Pharmacy, University of Benin were used. Animals were maintained under standard conditions and had access to standard diet (Ladokun feeds Ibadan) and water *ad libitum*. Experimental research reported in this manuscript, especially involving the use of animals, has been performed with the approval of an appropriate ethics committee.

Antipyretic Activity. The antipyretic activity was determined in female and male albino rabbits in quadruplicate at each dose. (modified from USP XXII, 1990). Thus 4 results were obtained for each dose. Pyrexia was induced by *Escherichia coli*, at a dose of 10^6cfu /ml. *Escherichia coli* was injected intravenously via the marginal ear vein, at a dose of 1ml/ 5kg body weight of the rabbits. An hour later the extracts, aqueous and ethanolic (500mg/kg & 1000mg/kg) were given via the oral route. The control groups were given distilled water (0.5 ml) and the standard reference drug, aqueous solution of acetylsalicylic acid (100 mg/kg). Rectal temperature was first recorded prior to induction of pyrexia with a probe thermometer and thereafter from time of injection of pyrogen up to 150 minutes at 15-minute intervals.

Statistical analysis: All data were expressed as mean ± SEM and in bar graphs and, where applicable was, analyzed by student's t-test using graph pad version 2.05a. The level of significance was $p<0.05$.

Results

The results in Table 1 shows the effect of both the aqueous and ethanolic extract on pyrogen induced pyrexia. The effect of the aqueous extract was not significant except at the 45^{th} minute with the 500mg/kg dose. Figs 1 and 2 show the effect of the aqueous and ethanolic extract on pyrexia respectively. An hour following the injection of *Escherichia coli*, the rectal temperatures were significantly elevated ($p<0.05$), and persisted for the distilled water treated group (control). However 15 minutes after the administration

of *K. africana* (ethanolic extract) and aspirin, the 1000mg/kg dose of *K. africana* significantly reduced this pyrexia ($p<0.05$). The effect of the ethanolic extract at 500mg/kg was comparable to that of aspirin. However the effect of the aqueous extract was not statistically significant at both doses tested.

Table 1: Influence of *Kigelia africana* and acetylsalicylic acid on pyrogen induced hyperthermia in rabbits.

Treatments (mg/kg)	Mean Rectal temperatures (°C) ±SEM (n = 4)							
	T_i	T_o	15 min	30 min	45 min	60 min	75 min	90 min
Aspirin (100)	37.21 ± 0.34	38.04 ±0.49	37.07 ±0.42[a]	37.32 ±0.25[a]	37.21 ±0.19[b]	37.41 ±0.28[a]	38.14 ±0.17	38.17 ±0.41
Aq. extract (500)	37.53 ± 0.14	38.63 ±0.35	37.76 ±0.67	37.87 ±0.63	37.54 ±0.45[a]	38.03 ±0.44	38.02 ±0.67	38.11 ±0.37
Aq. extract (1000)	37.59 ± 0.29	38.64 ±0.34	38.34 ±0.61	38.58 ±0.47	38.17 ±0.35	38.41 ±0.39	38.52 ±0.34	38.59 ±0.32
EtOH extract. (500)	37.26 ± 0.22	38.92 ±0.37	38.29 ±0.37	37.89 ±0.44	37.57 ±0.54[a]	38.09 ±0.50	39.03 ±0.40	38.79 ±0.43
EtOH extract (1000)	37.84 ± 0.32	38.51 ±0.52	37.50 ±0.42[a]	37.23 ±0.45[a]	37.65 ±0.36[a]	38.46 ±0.16	38.69 ±0.17	38.74 ±0.36
Distilled water	37.87 ± 0.45	38.50 ±0.29	38.56 ±0.26	38.83 ±0.22	38.81 ±0.20	38.86 ±0.24	38.89 ±0.33	38.97 ±0.24

[a] $p < 0.05$, [b] $p < 0.001$, significantly different from control.;

T_i = Initial mean rectal temperature recorded prior to induction of pyrexia

T_o = mean pyretic rectal temperature recorded just before plant extracts, aspirin and distilled water administration.

Discussion

Phytochemistry. The stem bark was observed to contain saponins, carbohydrates, glycosides and reducing sugars with no traces of alkaloids, tannins and anthracene derivatives.

Anti pyretic screening. Based on the results shown in table 1, figures 1 and 2 ,an hour after *Escherichia coli* injection, a significant hyperthermia was recorded and remained stable for the control group that received distilled water. However 15 minutes after administering the extract (aqueous and ethanolic) and aspirin, the ethanolic extract (1g/kg) significantly reduced this hyperthermia ($P<0.05$), while the aqueous extract(500mg/kg) significantly reduced hyperthermia at the 45th minute.($P<0.05$). This was not dose dependent for the aqueous extract as a higher dose did not give a better reduction than the lower dose however for the ethanolic extract, it was dose dependent. However the temperature rose an hour later after administering the extracts and aspirin.

Figs 1 and 2 show the effect of both the aqueous and ethanolic extracts of *Kigelia africana* on pyrexia being compared with aspirin and the control group. The temperatures of the ethanolic extract treated animals was significantly reduced ($P < 0.05$) between the 15th and 45th minute. This is comparable to the aspirin treated group, though its' effect lasted 15 minutes longer than that of the ethanolic extract. However the aqueous extract at 1g/kg did not significantly reduce this pyrexia. The ethanolic extract (1g/kg) gave the strongest antipyretic effect with a reduction of 3.5%, 30 minutes after it was administered. The results showed that the ethanolic extract has an anti pyretic action comparable to that of 100mg/kg aspirin as documented by the reduction of hyperthermia, 15minutes after administration of the extracts.($P<0.05$) Its probable mechanism is most likely via the inhibition of prostaglandins synthesis.(Al-Ghamdi, 2001., Backhouse, 1996).

Conclusion

This data provide pharmacological basis for some of the traditional uses of *Kigelia africana* which is include treatment of malaria, fever, kidney disorders, rheumatism and dysentery. Its use as febrifuge is also often reported and frequently goes into the treatment of various ailments in which inflammatory processes could be involved. Thus, we can affirm that *Kigelia africana* has anti pyretic properties and may act by inhibiting the synthesis of prostaglandins.

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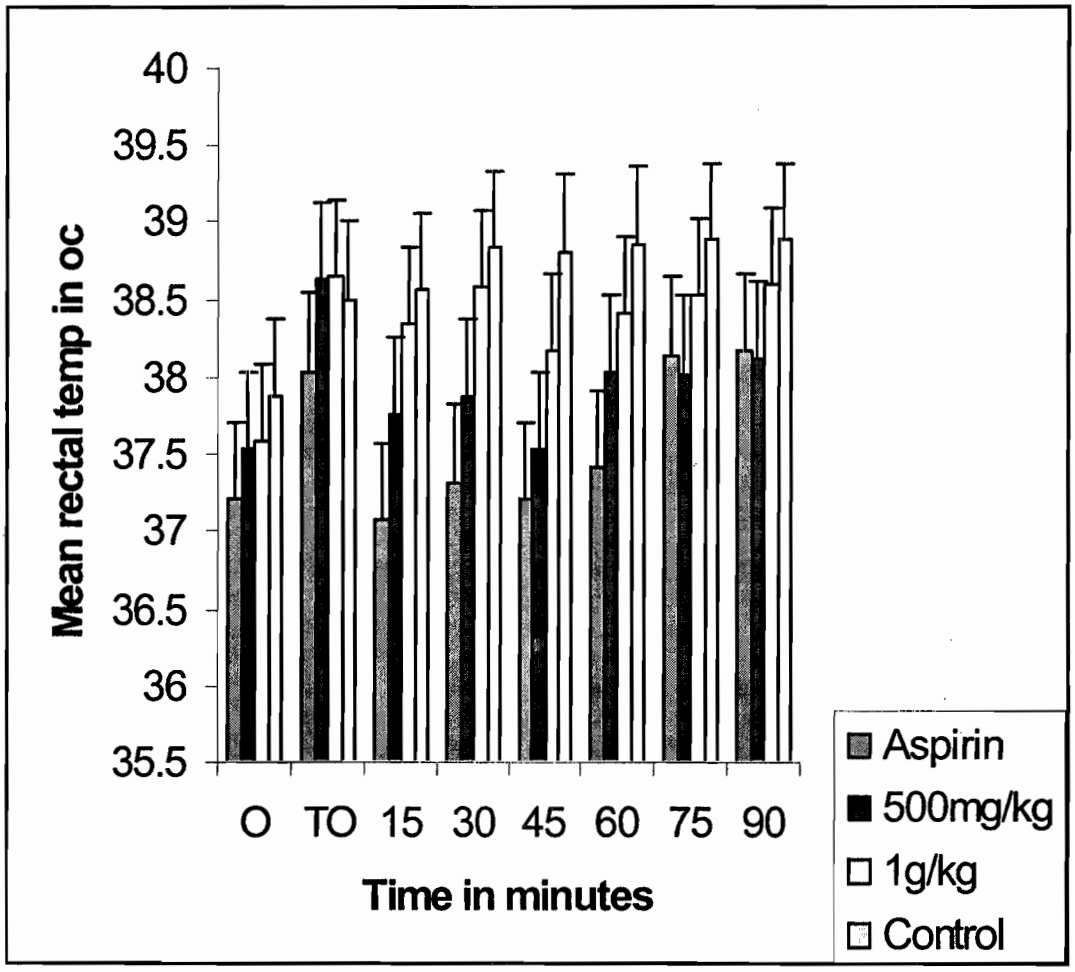

Fig 1 Effect of aqueous extract of *Kigelia africana* (500mg & 1g/kg) on pyrogen induced pyrexia in **rabbits** compared to the control and Aspirin groups

O: Initial mean rectal temperature recorded prior to induction of pyrexia

To: mean pyretic rectal temperature recorded just before plant extracts, aspirin and distilled water administration.

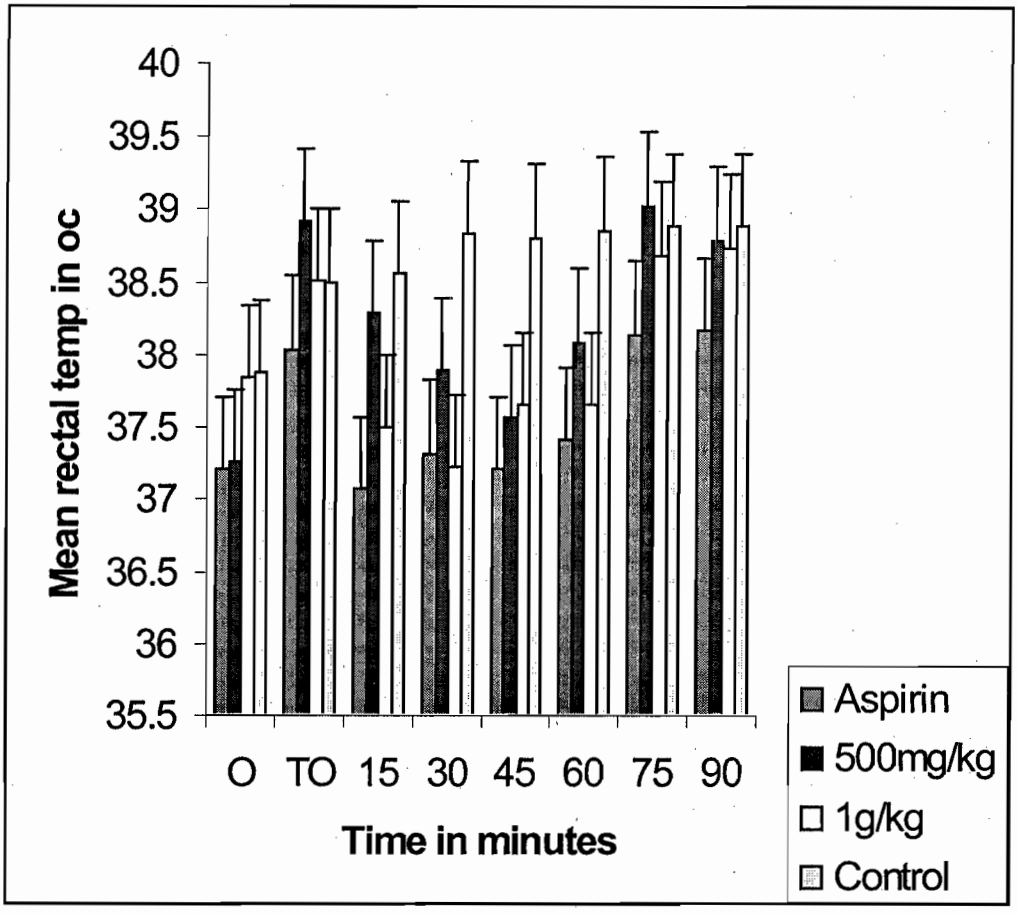

Fig 2: Effect of ethanolic extract of *Kigelia africana* (500mg & 1g/kg) on pyrogen induced pyrexia in rabbits compared to the control and Aspirin groups.

O: Initial mean rectal temperature recorded prior to induction of pyrexia

T_o: mean pyretic rectal temperature recorded just before plant extracts, aspirin and distilled water administration.

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