



Anti-anaemic activity of *Spondias mombin* and *Khaya grandifoliola* aqueous extracts on rats

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Abstract

Aqueous extracts of *Spondias mombin* leaf and *Khaya grandifoliola* stem bark at various doses were investigated for anti-anaemic activity in an *in vivo* model using albino rats. Activity was determined by measuring haematological parameters like packed cell volume (PCV), haemoglobin count (Hb) and white blood cell count (WBC). Anaemia was induced with by dosing control rats with 50 mg/ kg of chloramphenicol for two weeks. Oral administration of *S. mombin* extracts at doses of 100 -400 mg/kg to anaemic rats resulted in significant ($P < 0.1$) dose-dependent increases in PCV and Hb. Similar extracts of *K. grandifoliola* did not give significant ($P > 0.05$) recovery from anaemia when tested at 50-200 mg/kg. A fall in WBC was recorded with both extracts. This investigation has validated the use of *S. mombin* as a haematinic in traditional medicine.

Keywords: *Spondias mombin*, *Khaya grandifoliola*, haematological parameters, aqueous extract, anti-anaemic activity

Introduction

Spondias mombin L. (Anacardiaceae) is a tree up to 20 m, widespread in farmlands and growing easily from stakes for making fence and enclosure (Burkill, 1985). *S. mombin* is traditionally employed as a purgative, anthelmintic, analgesic, haemostatic and remedy for cough and gonorrhoea (Burkill, 1985). *Khaya grandifoliola* (Desv.) A. Juss. (Meliaceae) is a tree up to 15-30 m. indigenous to the riverine forests and savanna woodlands extending from West Africa to Sudan (Adjanohoun *et al.*, 1991). It is a popular remedy for fever, liver fluke, ulcer, and also used as haematinic (Adjanohoun *et al.*, 1991).

Anaemia is a deficiency of red blood cells which significantly reduces the ability of blood to carry oxygen to body tissues. It can be prompted by certain disease conditions, resulting in unusual tiredness and other symptoms, and can be fatal. It is often managed therapeutically by good dietary intake and iron supplements. Both *S. mombin* and *K. grandifoliola* are listed among the remedies for anaemia in the Nigerian traditional medicine (Adjanohoun *et al.*, 1991).

Apart from some pharmacological studies on *S. mombin* (Corthout *et al.*, 1992; Ayoka *et al.*, 2006) and *K. grandifoliola* (Owolabi *et al.*, 1990; Agbedahunsi *et al.*, 1998; Bumah *et al.*, 1999).

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al., 2005), there has been no report on the anti-anaemic claim on these two plants. In view of the economic importance of this disease in developing countries prompted by lack of good diet, we therefore investigated *S. mombin* leaf and *K. grandifoliola* stem bark for anti-anaemic activity on rats.

Experimental

Plant material and extraction. Leaves of *S. mombin* were collected from trees growing in Sagamu, Ogun State, while the stem bark of *K. grandifoliola* was harvested from trees in Ijebu-Igbo forest reserve in Ogun State. Authentication was done at the Forestry Research Institute of Nigeria (FRIN), Ibadan where voucher specimens (*S. mombin* FHI 106132, and *K. grandifoliola* FHI 10692) were deposited. The samples were chopped separately into pieces with a knife, sun dried and pulverized. Powders of *S. mombin* and *K. grandifoliola* (350 each) were macerated with water to exhaustion, and the residues obtained after solvent removal yielded 9.74% and 9.56% respectively, for *S. mombin* and *K. grandifoliola*.

Anti-anaemic screening. Male and female albino rats (165-230 g, five groups of four animals each for each plant) were maintained under standard conditions at the animal house of the Department, and fed regularly with pellets and water *ad libitum* for a week before induction of anaemia. Haematological parameters such as packed cell volume (PCV); haemoglobin count (Hb), and white blood cell count (WBC) were initially determined for untreated rats according to established methods (Baker *et al.*, 1998). Anaemia was induced orally with Chloramphenicol^R (50 mg/kg) for 2 weeks in four groups of rats, and confirmed by the markedly low PCV compared with the untreated rats (PCV, 42.25%). Anaemic groups of rats received oral administration of *S. mombin* (100 mg/kg- group A, 200 mg/kg- group B, 400 mg/kg- group C); and *K.*

grandifoliola (50 mg/kg-group A, 100 mg/kg-group B and 200 mg/kg- group C) extracts once daily for a week. The reference drug, ferrous gluconate (900 mg/kg) and distilled water were similarly given to the two control groups D and E respectively. All the treated animals were fed with water and pellets for a week. Animals were bled for determination of blood parameters- PCV, WBC, Hb (Baker *et al.*, 1998) before and after administration of the extracts and reference drug. Percentage recovery for each haematological parameter was calculated using the following formula typical of PCV:

$$\% \text{ Recovery} = \frac{(\text{PCV post-treatment}) - (\text{PCV pre-treatment})}{(\text{Normal PCV} - \text{PCV pre-treatment})} \times 100$$

Statistical significance was determined by the student's *t*-test compared with control. Values with $P < 0.05$ (for *K. grandifoliola*) and $P < 0.1$ (for *S. mombin*) were considered significant.

Results and Discussion

Aqueous leaf extract of *S. mombin* at 100-400 mg/kg, gave dose-dependent increases in PCV, Hb and WBC ($P < 0.1$) after 7 days of oral administration to experimental rats (Table 1). Dose-dependent decreases in percentage recoveries were also evident at these doses. However, aqueous extract of *K. grandifoliola* stem bark at the tested doses of 50 -200 mg/kg did not give dose-dependent increases in PCV and haemoglobin values. Such increases in PCV and haemoglobin count of rats after treatment with the extracts were obvious indices for recovery from anaemia (Onyeyili, *et al.*, 2001). Using normal rats, Adebajo *et al.* (2006) also found a progressive increase in PCV after an initial fall, following sub-chronic administration of *Murraya koenigii* extract. The changes recorded in the haematological parameters with *K. grandifoliola* extract were not statistically significant at the 95% confidence limit for all groups (Table 2). Recently,

Bumah *et al.* (2005) reported the biochemical effects of *K. grandifoliola* stem bark extract on rats.

Post-administration of extracts of both plants resulted in decreases in the WBC count. This might be expected since chloramphenicol which was used to induce anaemia is considered as a high risk drug which obviously affects the immune system of the experimental animal leading to a fall in WBC. Prolonged administration of the extract beyond 7 days might restore the WBC. Furthermore, the test animals administered with *K. grandifoliola* extract did not show significant changes in PCV, haemoglobin and percentage recovery from anaemia after 7 days experimental period, which suggests that this plant may not be an effective haematinic or anti-anaemic agent. The effects of other plant extracts on haematological parameters of experimental animals have been documented (Maduka *et al.*, 2002; Saeed and Sabir, 2003; Owoyele *et al.*, 2004).

Recovery from anaemia as measured by the haematological parameters, following administration of the extracts of both plants was higher at all tested doses of *S. mombin* than for the reference compound, ferrous gluconate. In addition, none of the tested doses of extracts of the two plants restored

fully the PCV (24-26.80 % for *S. mombin*, and 23-28% for *K. grandifoliola*) and Hb (8 - 8.92 g/dl for *S. mombin*, and 7.93-9.43 g/dl for *K. grandifoliola*) of the treated rats when compared with untreated rats (PCV 42.25%, Hb 12.7 g/dl). It has been suggested that full recovery of experimental animals from biochemical effects of plant extracts (Bumah *et al.*, 2005; Adebajo *et al.*, 2006) could be achieved by chronic administration of the extracts. According to a preliminary survey conducted in the Sagamu and Ikenne Local Government Areas of Ogun State, *S. mombin* and *K. grandifoliola* are widely employed in traditional medicine as anti-anaemics.

From this study, *S. mombin* gave comparable haematological effects with the reference drug when administered to experimental rats, and therefore suggests aqueous leaf extract of this plant as a haematinic and blood enhancer, and consequently validates its use as such. It has also reported the insignificant contribution of *K. grandifoliola* to recovery from anaemia.

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Table 1: Effect of *Spondias mombin* leaf extract on haematological parameters

Dose of extract (mg/kg)	Packed Cell Volume (%)			Haemoglobin count (g/dl)			White Blood Cell count ($\times 10^3/\text{mm}^3$)	
	Pre-treatment	Post-treatment	Recovery (%)	Pre-treatment	Post-treatment	Recovery (%)	Pre-treatment	Post-treatment
100	16.25 \pm 2.89	24.00 \pm 0.40	41.30	5.40 \pm 0.96	8.00 \pm 0.25	34.20	5.40 \pm 0.78	5.00 \pm 0.23
200	22.80 \pm 2.12	25.30 \pm 0.75	20.50	7.60 \pm 0.55	8.42 \pm 0.25	15.19	7.35 \pm 1.36	5.45 \pm 0.54
400	24.80 \pm 0.48	26.80 \pm 0.85	19.60	8.30 \pm 0.16	8.92 \pm 0.28	13.19	10.90 \pm 0.43	7.56 \pm 1.12
Control*	20.00 \pm 3.70	21.70 \pm 2.73	11.33	6.70 \pm 1.20	7.20 \pm 0.91	7.90	3.47 \pm 0.60	4.13 \pm 0.70
Untreated control		42.25 \pm 5.5			12.70 \pm 1.60			-

* (ferrous gluconate, 0.9 g/kg) Each value represents mean \pm SEM (n=4); - = not determined

P < 0.1 significantly different compared with reference compound, ferrous gluconate, Student's *t*-test.

Table 2: Effect of *Khaya grandifoliola* stem bark extract on haematological parameters

Dose of extract (mg/kg)	Packed Cell Volume (%)			Haemoglobin count (g/dl)			White Blood Cell count ($\times 10^3/\text{mm}^3$)	
	Pre-treatment	Post-treatment	Recovery (%)	Pre-treatment	Post-treatment	Recovery (%)	Pre-treatment	Post-treatment
50	20.75 \pm 5.0	28.25 \pm 3.3	30.93	7.00 \pm 2.0	9.43 \pm 1.2	27.00	4.55 \pm 0.5	2.78 \pm 0.5
100	13.75 \pm 3.1	23.75 \pm 2.4	32.00	4.60 \pm 2.1	7.93 \pm 0.8	29.21	7.98 \pm 1.0	3.75 \pm 0.1
200	20.75 \pm 5.0	28.00 \pm 1.2	29.90	6.93 \pm 1.7	9.33 \pm 0.4	26.46	4.60 \pm 1.1	3.75 \pm 0.9
Control*	20.00 \pm 3.70	21.70 \pm 2.73	11.33	6.70 \pm 1.20	7.20 \pm 0.91	7.90	3.47 \pm 0.60	4.13 \pm 0.70
Untreated control		42.25 \pm 5.5			12.70 \pm 1.60			-

* (ferrous gluconate, 0.9 g/kg) Each value represents mean \pm SEM (n=4); - = not determined

P < 0.1 significantly different compared with reference compound, ferrous gluconate, Student's *t*-test.

References

- Adebajo, A. C., Ayoola, O. F., Iwalewa, E. O., Akindahunsi, A. A., Omisore, N. O. A., Adewunmi, C. O., Adenowo, T. K., 2006. Anti-trichomonal, biochemical and toxicological activities of methanolic extract and some carbazole alkaloids isolated from the leaves of *Murraya koenigii* growing in Nigeria. *Phytomedicine* 13, 246-254.
- Adjanohoun, E., Ahiyi, M. R. A., Ake-Assi, L., Dramane, K., Elewude, J. A., Fadoju, S. O., Gbile, Z. O., Goudote, E., Johnson, C. L. A., *et al.* 1991. Traditional Medicine and Pharmacopoeia. Contribution to ethnobotanical and floristic studies in Western Nigeria. OAU/ STRC publications, Lagos. p.149.
- Agbedahunsi, J. M., Elujoba, A. A., Makinde, J. M., Oduola, A. M. J., 1998. Antimalarial activity of *Khaya grandifoliola* stem bark. *Pharmaceutical Biol.* 36, 8-12.
- Ayoka, A. O., Akomolafe, R. O., Iwalewa, E. O., Akanmu, M. A., Ukponmwan, O. E., 2006. Sedative, antiepileptic and antipsychotic effects of *Spondias mombin* L. (Anacardiaceae) in mice and rats. *J. Ethnopharmacol.* 103, 166-175
- Baker, F. J., Silverton, R. E., Pallister, C. J., 1998. Baker and Silverton's Introduction to Medical Laboratory Technology., 7th ed., pp.356-360.
- Bumah, V. V., Essien, E. U., Agbedahunsi, J. M., Ekah, O. U., 2005. Effects of *Khaya grandifoliola* (Meliaceae) on some biochemical parameters in rats. *J. Ethnopharmacol.* 102, 446-449.
- Burkill, H. M., 1985. The Useful Plants of West Tropical Africa, 2nd ed. (Families A-D) Royal Botanic Gardens, Kew, London.
- Corthout, J., Pieters, L., Claeys, M., Vanden Berghe, D., Vlietinck, A., 1992. Antiviral caffeoyl esters from *Spondias mombin*. *Phytochemistry* 31, 1979-1981.
- Maduka, H. C. C., Okoye, Z. S. C., Eje, A., 2002. The influence of *Sacoglottis gabonensis* stem bark extract and its isolate bergenin, Nigerian alcoholic beverage additives, on the metabolic and haematological side effects of 2,4-dinitrophenyl hydrazine-induced tissue damage. *Vascular Pharmacol.* 39, 317-324.
- Owolabi, O. A., Makanga, B., Thomas, E. W., Molyneux, D. H., Oliver, R. W. A., 1990. Trypanocidal potentials of African woody plants: *In vitro* trial of *Khaya grandifoliola* seed extracts against *Trypanosoma brucei brucei*. *J. Ethnopharmacol.* 30, 227-231.
- Owoyele, BV, Alabi, O. T., Adebayo, J. O., Soladoye, A. O., Abioye, A. I. R., Jimoh, S. A., 2004. Haematological evaluation of ethanolic extract of *Allium ascalonicum* in male albino rats. *Fitoterapia* 75, 322-326.
- Onyeyili, P. A., Nwosu, C. O., Amin, J. D., Jibike, J. I., 2001. Anthelmintic activity of crude aqueous extract of *Nauclea latifolia* stem bark against ovine nematodes. *Fitoterapia* 72, 12-21.
- Saeed, M. A., Sabir, A. W., 2003. Effects of *Fagonia cretica* L. constituents on various haematological parameters in rabbits. *J. Ethnopharmacol.* 85, 195-200.