Evaluation of *Telfaria occidentalis* and sorghum bicolor extracts as potent haematinics in domestic rabbits

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Abstract

A total of 20 domestic rabbits divided into 4 groups of animals per group were used in this study. Group A animals (control) were not bled but those in groups B-D were bled to induce anaemia. Group B animals were left to recover by normal haemopoiesis while those in groups C and D were treated respectively with Haematopan B12 ® (a commercially prepared haematinic) and alcohol extracts of a combination of *Sorghum bicolor* and *Telfaria occidentalis*, reconstituted at concentration of 4mg/100ml of distilled water. The post-haemorrhage treatment haematologic values were obtained at given intervals (7 days) and compared with the pre-haemorrhage values earlier obtained. The study showed that the group B animals recovered gradually by physiologic haemopoiesis while animals in group C and D showed accelerated recovery with group D animals having a faster and better response in terms of packed cell volume (PCV), white blood cell (WBC), red blood cell (RBC), haemoglobin (Hb), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV). Thus the combination of the extracts used in the treatment of the anaemic rabbits was a potent haematinic.

Keywords: Extracts, *Telfaria occidentalis*, *Sorghum bicolor*, haematinics, domestic rabbits.

Introduction

It has been observed that in the tropical environment animals reared under extensive husbandry system seem to thrive better and are usually able to withstand some of the endemic diseases to which intensively managed animals continually remain susceptible. This apparent resistance has been attributed, at least in part, to adequate exercise and the possibility of selective and unrestricted grazing whereby a wide variety of edible forages are available to the animals. Some of such plants have been shown to provide not only nutritional but also medicinal benefits (Burkill, 1985). Man is also known to consume a wide variety of local crops

and vegetables which are believed to contribute significantly to the improvement of human health in terms of disease prevention and therapy.

This study is a preliminary ethropharmacological investigation aimed at providing scientific support to some common traditional beliefs involving the use of a few local plants and herbs in ethno-veterinary medical practices. Particular attention has therefore been given in this study to the use of *Telfaria occidentalis* (local name – Ugu) and *Sorghum bicolor* (local name – Oka baba) which are being proposed in traditional settings as having potential haematinic properties.

Materials and methods

Experimental animals

A total of 20 domestic rabbits (*Oryctolagus cuniculi*) of either sex, ranging in age from weaners to adults were used for this study. The animals were housed in the experimental animal house of the Department of Veterinary Physiology and Pharmacology, University of Ibadan. The animals were stabilized and health status were properly monitored before being used for the study. The animals were fed twice in a day with commercially prepared rabbit's grower mash. Good drinking water was provided *ad libitum* for the animals.

Plants under study

Fresh samples of *Sorghum bicolor* and *Telfaria occidentalis* were obtained respectively from Oje and Bodija markets, both in Ibadan. The samples were dried on the bench before the extraction process was embarked upon at the Extraction Laboratory of the Department of Chemistry, University of Ibadan. The extraction procedure is as described by Harborne (1973). The dried leaves were crushed into a coarse powder form and weighed. The powdered leaves were continually extracted using absolute ethanol in a soxhlet extractors until all the pigment was in the extract. The extract obtained was clarified by filtration through celite on a water pump and was then concentrated in vacuo using a rotation evaporator which concentrates bulky solutions down to small volumes without bumping at low temperatures. The ethanol remaining in the extract was finally removed by placing small volumes in porcelain dishes in the oven set at low temperatures of 40°C. This provided the semi-solid materials from which a dose of 4mg/100ml distilled water was made.

Other materials used

Other materials and equipment used in this study included Soxhlet extractor, milling machine, chemicals like hexane, absolute

ethanol, ethylenediamine tetraacetic acid (EDTA), xylene etc. Also included were methylated spirit, scalpel blades, vaseline (Petroleum jelly), cotton wool, light microscope, haematological graphic reader, haemocytometer etc.

Pre-hemorrhage sampling

About 1ml. of blood sample was obtained from each rabbit into heparinised tubes to determine the initial blood parameter before bleeding. Blood collection was by puncturing the prominent ear veins with scalpel blade and application of vaseline to facilitate blood flow.

Induction of anaemia

It is an established fact that a rabbit has between 57.7-70ml of blood per kilogram body weight (Kalpan and Timmons, 1979). Also, a loss of about one-third of the total blood volume of an animal is known to precipitate anaemia (Taiwo and Anisa, 1995). Therefore, based on their body weights, one-third of the total blood volume of the rabbit was collected through bleeding to induce clinical anaemia.

The bleeding was carried out through the veno-puncture via the prominent ear vein. The punctured site was rubbed with some Vaseline to prevent clotting and enhance continuous bleeding. The blood was then collected into a graduated bottle until the desired volume was obtained. To ensure that clinical anaemia had been induced, the rabbits were bled again 24 hours post-haemorrhage and the 2mls of blood collected from each rabbit was used for laboratory analysis for confirmation of clinical anaemia.

Treatment of anaemia

Use of Haematopan B12®

This commercially prepared haematinic was administered intramuscularly through the thigh muscles at a dose rate of 0.5-2.0 ml per rabbit depending on body weight for rabbits in group C.

Table 1 Normal haematological values of experimental rabbits

Measurements	Treatments			
	A	B	C	D
PCV	2.16 ± 4.10	21.4 ± 3.85	33.6 ± 3.36	33.6 ± 2.07
WBC	2480 ± 1391.31	2603 ± 1365.94	7010 ± 1397.81	5740 ± 1336.69
RBC	3.76 ± 2.17	3.176 ± 0.98	4.674 ± 0.81	4102 ± 0.58
HB	9.78 ± 2.42	9.48 ± 1.18	11.7 ± 3.42	9.34 ± 4.53

Table 2 Haematological values of experimental rabbits on the 3rd day

Measurements	Treatments			
	A	B	C	D
PCV	19.8 ± 3.90	15.6 ± 4.56	28.4 ± 2.61	22.6 ± 7.96
WBC	2458 ± 1403.70	2011.6 ± 1316.84	5050 ± 2046.83	7590 ± 2373.39
RBC	3.41 ± 2.14	3.234 ± 1.96	4.43 ± 1.11	3.908 ± 1.09
HB	8.88 ± 1.78	6.1 ± 2.20	7.84 ± 2.78	7.98 ± 1.22

Table 3 Haematological values of experimental rabbits on the 10th day

Measurements	Treatments			
	A	B	C	D
PCV	21 ± 2.83	20.6 ± 6.15	28 ± 2.74	26.8 ± 5.81
WBC	2726 ± 1232.02	2540 ± 1038.03	5200 ± 2590.37	7360 ± 2944.15
RBC	4.328 ± 1.24	4.01 ± 1.62	4.38 ± 0.71	4.41 ± 1.38
HB	9.22 ± 1.82	7.28 ± 2.12	7.7 ± 0.91	7.84 ± 2.34

Table 4 Haematological values of experimental rabbits on the 17th day

Measurements	Treatments			
	A	B	C	D
PCV	22.6 ± 3.65	22.4 ± 4.34	29.8 ± 3.56	32.2 ± 3.11
WBC	3224 ± 1199.95	4870 ± 3740.42	4400 ± 2167.08	5920 ± 1295.96
RBC	4.59 ± 1.27	4.096 ± 0.59	4.98 ± 0.52	5114 ± 0.99
HB	10.004 ± 1.51	6.54 ± 0.96	7.76 ± 1.30	9.06 ± 1.08

Table 5 Haematological values of experimental rabbits on the 24th day

Measurements	Treatments			
	A	B	C	D
PCV	22.8 ± 3.42	22.4 ± 4.56	26.4 ± 1.82	32.2 ± 1.79
WBC	3142 ± 1433.64	4601.2 ± 1761.18	4600 ± 809.32	6130 ± 1079.70
RBC	4.702 ± 1.31	4.132 ± 0.62	4.388 ± 0.36	5.564 ± 0.37
HB	9.32 ± 1.22	6.76 ± 0.43	7.28 ± 0.94	8.64 ± 1.36

Table 6 Haematological values of experimental rabbits on the 31st day

Measurements	Treatments			
	A	B	C	D
PCV	22 ± 2.74	22 ± 3.74	28.8 ± 1.79	35 ± 1.41
WBC	2540 ± 1145.86	4956 ± 2388.74	7050 ± 1126.94	5850 ± 1103.40
RBC	3.88 ± 0.94	4.04 ± 0.55	5.226 ± 0.60	5.882 ± 0.61
HB	9.42 ± 1.81	6.54 ± 0.94	7.82 ± 1.10	8.72 ± 0.55

Use of combination of the extracts of sorghum bicolor and Telfaria occidentalis

These 2 extracts were reconstituted in distilled water at the concentration of 4mg/100ml of distilled water separately. Some 0.6ml of each of the extract to make 1.2 mls of the 2 extracts were obtained and administered into the rabbits in group D. The animals in groups A and B were not treated at all.

Post-treatment blood sample analysis

The first set of blood samples were collected for laboratory analysis, 3 days following the completion of treatment course. Thereafter, post treatment blood samples were collected at 7 days intervals for follow-up laboratory analysis. The blood samples collected were analyzed at the clinical pathology laboratory of the Faculty of Veterinary Medicine, University of Ibadan.

Packed Cell Volume (PCV) estimation was carried out by the use of haematocrit reader while cyanomethaemoglobin method was used to determine haemoglobin (Hb) concentration. The red blood cell (RBC) and total white blood cell (WBC) counts were carried out by the use of the Neubauer haemocytometer.

Statistical analysis

Results were expressed as the mean measurement ± standard deviation of the mean. Differences between mean values were evaluated using the student's test. Differences are significant at $P < 0.05$ (Bradford and Hill, 1991).

Results

The haematological indices used to estimate the haematinic potency of these herbs such as packed cell volume (PCV), red blood cell (RBC) white blood cell (WBC) and haemoglobin concentration were affected in one way or the other in the course of this study in the different animal groups.

The PCV values experienced an increase for all the animal groups until the 31st day after treatment. The RBC also followed similar pattern in that the RBC concentration that came down after initial bleeding gradually experienced an increase until the 31st day. Haemoglobin concentration also experienced an increase in a similar fashion. (Tables 1-6). WBC values decreased with days.

Within and between the groups, it was noted that the animals in group D had the highest values in terms of PCV, RBC and Hb concentration. This was followed by animals in group C, while group B animals recovered by natural haemopoiesis. Group A animals were not directly involved since these groups of animals were not bled in the first instance (Tables 1-6).

Discussion

The combined extract of *Telfaria occidentalis* and *sorghum bicolor* was observed to produce some haematinic effects. This was shown by the changes noted in the level of the packed cell volume (PCV), red blood cell (RBC) count and haemoglobin (Hb) concentration.

The initial thing was to compare the values of these measurements (PCV, RBC and Hb), pre and post-haemorrhages. It was observed that by the 31st day, the values for these parameters had experienced a slight increase over the pre-haemorrhagic values, though the difference was not statistically significant ($P < 0.05$). The reverse for the WBC, and the difference was statistically significant for groups A., B and D while it was not significant for group C.

The measurements were also compared between groups. For instance, group D animals had the highest value when compared with the remaining group i.e. A, B and C. As a matter of fact when the PCV values for groups D and C were compared, the difference was statistically significant using student test at $P < 0.05$. The implication of this is that the combined extracts of *Telfaria occidentalis* and *sorghum bicolor* had greater influence on the total percentage of blood volume composed of packed cellular elements. Most species of domestic animals have PCV values of 38 to 45 percent with a mean of 40. Haemoconcentration due to dehydration, asphyxia, or excitement causing release of erythrocytes concentrated in the spleen can result in abnormally high PCV values (Swenson and Reece, 1993). It is thus possible that these extract have effect on the spleen resulting in the release of the contained erythrocytes. One can also deduce that increase in both the hemoglobin concentration (Hb) as well as red blood cell (RBC) count may also be a result of this observation that the extracts may have an effect on the spleen. This is because when the mean values of the red blood cell (RBC) count of groups A and D animals were compared, that of group D was not only higher but the difference was statistically significant ($P < 0.05$). Though the RBC count for group D was slightly higher than that of group C, the difference, however, was not statistically significant. The implication of this observation is that the extracts have positive effect on

haemopoiesis as much as the commercial haematinic. The profound effect of these extracts is particularly impressive knowing fully well that the major function of the red blood cell (RBC) is to transport oxygen from the lungs to the tissues. Also, because the red blood cells are responsible for approximately 70% of all the buffering power of the whole blood (Guyton, 1961), it therefore means that these extracts will also have effect on the buffering activity of the red blood cell.

In the case of the white blood cell, the group D animals also have higher value when compared with group C, though the difference is not statistically significant ($P < 0.05$). It thus shows that the effects of the combined extracts of these 2 local herbs and the commercial haematinic are similar. On the other hand, the effects of the extracts is well pronounced when compared with group A. When, however, groups B and D were compared, the difference was not statistically significant, though group B was slightly higher. The implication of this is that these herbs may not have any direct effect on white blood cell count but the increase noted in groups B, C and D over group A is because these animals were bled and the white blood cells, principally neutrophils and macrophages (derived from monocytes) found at sites of inflammation, constitute the prime defensive features of the inflammatory response (Robins, 1974). It thus implies that the increase in white blood cell (WBC) count is in response to inflammation reaction initiated as a result of the haemorrhage.

In the case of the haemoglobin concentration, groups C and D animals had similar value though group D was slightly higher but the difference was not statistically significant. There was a significant difference between group B and D when compared but group A had a higher value where the difference was not statistically significant when compared with

group D. This also reveals that the effect of proprietary haematinic used in this study is similar to that of the combined extracts in relation to the haemoglobin concentration. If this is the case then, the combined extract could be described as having haematinic properties since a haematinic is an agent which improves the quality of blood in terms of erythrocytes and haemoglobin concentration (Brander *et al.*, 1982).

From all indications, the components of the extracts were capable of stimulating both the bone marrow and other haemopoietic organ and thus able to raise the depressed blood volume when administered parenterally in standard concentration of 4% solution. Also, the local use of these combined extracts in the management of anaemic patients and relatively healthy subjects is unquestionable and should therefore be encouraged since these plants are cultivated in Nigeria and some other countries of West African sub-region. The plants are also available and popular with the local people (Lowe, 1989).

References

- Bradford, H. A., and Hill I. D. 1991. Principles of Medical Statistics, 12th Ed. Edward Arnold, London.
- Brander, G. C., Pugh, D. M. and Bywater, R. J. 1982. *Veterinary applied Pharmacology and Therapeutics*. Balliere Tindall, London pp. 141-144.
- Burkill, H. M. 1985. *The useful plants of west Tropical Africa*, Vol. I (Families A-D). Royal Botanical Garden, Kew, England.
- Guyton, A. C. 1961. *Textbook of medical Physiology*, 2nd Ed. W. B. Saunders, Co., Philadelphia, pp. 162-164.
- Harborne, J. B. 1973. *Phytochemical methods*. Fakenham Press Limited, Norfolk, Britain.
- Kaplan, H. M. and Timmons, E. H. 1979. *The Rabbit, a model for the Principles of Mammalian, physiology and Surgery*. Academy Press, London, pp. 6-7.
- Lowe, J. 1989. *The flora of Nigeria (Grasses)* 2nd Ed. D. P. Stanfield.
- Robins, S. L. 1974. *Pathologic Basic of Disease*. 1st Ed. W/ B. Saunders, Co., Philadephia, pp. 704.
- Swenson, M. J. and Reece, O. W. 1993. *Duke's Physiology of Domestic Animals* 11th Ed. Comstock Publishing associates, Ithaca, U. S. A. pp. 30.
- Taiwo, V. O. and Anosa, V. O. 1995. Fibrinogen, Leukocyte and haematocrit value In Cattle, with various Disease Conditions. *Trop. Vet. Vol. 13* (1 & 2) pp. 51-58.

(Received 3 November 1999; Accepted 30 August 2000)