

Original article

## HEMOPOIETIC EFFECT OF AQUEOUS EXTRACT OF THE LEAF SHEATH OF *SORGHUM BICOLOR* IN ALBINO RATS

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The effect of an aqueous extract of the leaf sheath of *Sorghum bicolor* on hemoglobin (Hb), red blood cell count (RBC), packed cell volume (PCV), mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) was investigated in 50 albino rats. The rats were in 5 groups of 10 animals per group. The first group is the control and the 4 other groups were the experimental. These latter groups were given oral treatments of the sorghum extract in concentrations of 200mg/kg, 400mg/kg, 800mg/kg and 1,600mg/kg respectively for 16 days. Blood analysis was done at the end of 16 days. The extract of the leaf sheath of sorghum increased in a dose dependent manner Hb ( $P < 0.05$ ), RBC ( $P < 0.05$ ), PCV ( $P < 0.05$ ) and MCH ( $P < 0.001$ ). It however caused a decrease in MCV ( $P < 0.05$ ) and MCH ( $P < 0.05$ ). The result of this study thus supports the traditional use of sorghum bicolor as a remedy for anemia.

**Keywords:** *Sorghum Bicolor*, Leaf Sheaths, Rats, Blood

### INTRODUCTION

Sorghum is a major food crop in Africa and India and an important livestock feed in the Americas. Europe and Japan (Dogget, 1988). It is known under a variety of names such as Kaffir corn in Sour Africa, guinea corn in West Africa. It is also called Karan dafi by the Hausas of Northern Nigeria and Oka Pupa (red corn) by the Yorubas of Southern Nigeria (Dalziel, 1948). It has a variety of uses including its being the staple food for large populations in Africa and Asia. It is also used in making beers. In West Africa, dye extracted from the plant is used in coloring leather red or colouring of cloths, calabashes and as a body pigment (Cobley and Steele, 1976).

Much literature does not exist concerning the biological activities of this plant species. However, the prevalent use of the leaf sheaths as a remedy against anemia by the traditional medicine healers in Nigeria as well as the local people of the Yoruba and Hausa tribes led to the present investigations on this plant with particular interest on its effects on blood parameters.

### MATERIALS AND METHODS

**Plant Material:** Small bundles of the leaf sheaths of the sorghum plants were purchased from the herb sellers at Bodija Market, Ibadan. This plant was authenticated at the herbarium of the Botany Department, University of Ibadan.

**Preparation Material:** The leaf sheaths of the sorghum plants were dried initially in the sun for about 8 weeks. Further drying took place in the solar dryer of the Food and Technology Department of the University of Ibadan for about 3 weeks after which milling of the leaf sheaths was done with the roller milling machine. 868g of the

milled plant material was soaked in 4 litres of distilled water with intermittent agitation. After about 24 hours, the mixture was filtered and the filtrate distilled under reduced pressure by a vacuum pump and then concentrated by evaporation. The product here is in a semi-solid form. It is then evaporated to dryness at 60°C. The weight of the dried extract was 25.66g thus giving a percentage yield of 2.96 per cent of the starting sample.

**Animals:** Male and female albino rats of the Wistar Strain (90-100g) obtained from the animal house of the Department of Physiology, Ogun State University, Ago-Iwoye were used for this study. They were kept in rat cages with free access to water and dry rat pellet feeds (Ladokun Feeds Nigeria Ibadan).

### Acute Toxicity Studies:

**Mice:** Male and female Swiss albino mice, 30 in number and weighing between 15 and 20g were used to determine the toxicity of the extract. Graded doses of the extract were administered intraperitoneally to five groups of five mice per group in doses ranging from 20mg to 1,600mg after starvation for 24h. Another group of five mice served as the control group and this received (0.5ml) of normal saline. They were all placed under observation for the next 24 hours after which the number of dead mice was recorded. A median lethal dose (LD<sub>50</sub>) was calculated for this route of administration by the arithmetic method of Karber (Iyaniwura *et al*, 1990).

**Rats:** Different doses of the extract ranging 300mg to 3,200mg were administered to 5 groups of rats with 6 rats per groups using the same

procedure as above through oral administration. No mortality was recorded after 24 hours. It was thus concluded that the extract was quite safe and non-toxic through oral administration. A convenient range of dosage was then set out to apply to the animals for the experiment.s

**Hematological tests**

Male albino Wistar rats were put into 5 groups of 10 animals each. The first group is the control group. This received daily doses 0.5mg of 0.9 per cent NaCl. The second, third, fourth and fifth groups received 200mg/kg, 400mg/kg, 800mg/kg and 1,600mg/kg respectively in daily oral doses for sixteen days. Blood samples (0.5ml) were obtained after 16 days from each of the animals through ocular bleeding. This was used for the determination of blood parameters under investigation: Packed cell volume (PCV), Hemoglobin levels (Hb concentration) and red blood cell counts (RBC counts). Packed cell volume was measured by the microhaematocrit technique using a Hawksley microhaematocrit centrifuge and spinning for 5 min at 12,000 x g before reading with the hematocrit reader. Red cell counts were estimated by using the hemocytometer method. Hb levels were measured colorimetrically by the oxyhemoglobins methods using Reichert's haemoglobinometer.

**Statistical Analysis**

The results were expressed as mean ± SEM, differences between means analysed using Student-t-test. P values of 0.05 or less and 0.001 were taken as being statistically significant

**RESULTS**

The results of the acute toxicity study in mice showed the LD<sub>50</sub> of the sorghum extract to be 770mg/kg when administered intraperitoneally. However in the rats, higher doses of the extract administered orally was well tolerated. There was

no observed toxicity effect on the dosage used throughout the course of the experiments.

The effect of various doses of aqueous extract of the leaf sheath of sorghum of mean hematological parameters are shown in Table 2.

**Packed Cell Volume:** Increasing the dosage concentration of sorghum extract had an effect of increasing the PCV in all the treatment groups. PCV value at 200mg/kg 39.2 ± 2.06 per cent was however not significantly different from that of the control group 38.5 1.82 per cent. At high doses of the extract, 800mg/kg and 1,600mg/kg, there was a significant increase from 46.4 ± 0.6 per cent to 48.2 0.49 per cent respectively (P < 0.05).

**Hemoglobin Concentration):** increase in hemoglobin concentration occurred with increased concentration of applied extract. The hemoglobin value of 12.26 ± 0.29g of the control group increased to 15.22 ± 0.19g at 800mg/kg and 16.10 ± 0.07g at 1,600mg/kg respectively. All these values are significantly different from the control group (P < 0.05). Significant change in hemoglobin concentration also occurred between the two high doses i.e. 800 and 1,600mg/kg.

**Table 1:** Percent Mortality of Administration of Different Doses of Aqueous Extract of Leaf Sheath of Sorghum Bicolor to Mice

| Grp | Dose (mg/kg)         | Log-dose | Numbers of deaths recorded | Percent mortality |
|-----|----------------------|----------|----------------------------|-------------------|
| I   | 1,600                | 3.204    | 5                          | 100               |
| II  | 800                  | 2.903    | 3                          | 60                |
| III | 400                  | 2.602    | 1                          | 60                |
| IV  | 100                  | 2.000    | 0                          | 0                 |
| V   | 20                   | 1.3010   | 0                          | 0                 |
| VI* | 0.5ml <sup>N.S</sup> | -        | -                          | -                 |

\*Animals in Group VI were given 0.5ml of normal saline.

**Table 2:** Effect of Aqueous Extract of Leaf Sheath of Sorghum Bicolor on Hemotological parameters

| Treatment mg/kg | PCV (%) ± S.E.            | Hb(g) ± S.E.               | RBC X 10 <sup>9</sup> /mm ± S.E. | MCV ± S.E.x 10 <sup>6</sup> (FL) | MCH ± S.E. x 10 <sup>6</sup> (Pg) | MCHC (g/dL)                |
|-----------------|---------------------------|----------------------------|----------------------------------|----------------------------------|-----------------------------------|----------------------------|
| Control Saline  | 38.5 ± 1.82               | 12.26 ± 0.29               | 4.13 ± 0.23                      | 94.52 ± 0.7                      | 29.06 ± 0.1                       | 31.40 ± 0.1                |
| Extract 200     | 39.2 ± 2.06               | 13.34 ± 0.7 <sup>a</sup>   | 4.34 ± 0.18 <sup>a</sup>         | 90.32 ± 0.5 <sup>bd</sup>        | 32.53 ± .7 <sup>c</sup>           | 34.03 ± 0.001 <sup>c</sup> |
| Extract 400     | 43.83 ± 0.60 <sup>b</sup> | 14.75 ± 0.14 <sup>b</sup>  | 4.72 ± 0.07 <sup>b</sup>         | 92.90 ± 0.03 <sup>ad</sup>       | 32.0 ± 0.67 <sup>b</sup>          | 33.65 ± 0.06 <sup>ad</sup> |
| Extract 800     | 46.4 ± 0.6 <sup>bd</sup>  | 15.22 ± 0.19 <sup>b</sup>  | 5.04 ± 0.03 <sup>bd</sup>        | 91.94 ± 0.07 <sup>be</sup>       | 33.11 ± 0.06 <sup>c</sup>         | 32.80 ± 0.01               |
| Extract 1,600   | 48.2 ± 0.49 <sup>bd</sup> | 16.10 ± 0.07 <sup>bd</sup> | 5.63 ± 0.09 <sup>bd</sup>        | 85.74 ± 0.21 <sup>be</sup>       | 28.6 ± 0.14 <sup>be</sup>         | 33.4 ± 0.01 <sup>ce</sup>  |

**Note:** a = values not significantly different from control P > 0.05; b = values significantly different from control P < 0.05; c = values significantly different from control P < 0.00; d = values significantly different from preceding value P < 0.05; e = values significantly different from preceding value.

**Red Cell Count:** Animals that received 200 and 400mg/kg body weight of the extract had significantly lower red cell value  $P < 0.05$  than those who received 800 and 1,600mg/kg body weight of the extract. There was no significant difference between the red cell count of those that received 200mg/kg dose of extract and the normal saline in the control group.

#### **MCV, MCH AND MCHC**

Animals in the control group who received only normal saline had significantly higher MCV values  $P < 0.05$  than those recorded for all the groups of rats who received the extract in various doses. The MCV values increased from the extract dose of 200mg/kg to 400mg/kg body weight. However at 1,600mg/kg the MCV value ( $85.74 \pm 0.21$ )pg was lower than the value ( $90.32 \pm 0.05$ )pg obtained at the dose of 200mg/kg body weight.

The MCH showed a gradual and significant increase from the extract dose of 200mg/kg to 800mg/kg. However, a significant decrease ( $P < 0.05$ ) occurred at the dose of 1,600mg/kg compared to the control group ( $P < 0.001$ ). Except at the dosage of 400mg/kg the MCHC showed significant increases from extract dose of 200mg/kg to 1,600mg/kg ( $P < 0.001$ ).

#### **DISCUSSION**

The result of this study showed that the aqueous extract of the leaf sheath of sorghum bicolor increase the hemoglobin concentration, red cell count and packed cell volume in albino rats in a dose dependent manner. It is interesting however to note that low dosage applications of the extract (200mg/kg) does not significantly increase blood parameters when compared with the result obtained for the control group of animals who received normal saline.

Significant increase in blood parameters compared to the animals in the control group occurred from dosage of 400mg/kg to the highest dose 1,600mg/kg in all treatment groups. Furthermore, for the packed cell volume, significant increase occurred only within the high dosage ranges.

The same trend can be observed concerning changes in haemoglobin concentration and the red

cell counts. Very significant increase took place within the highest doses of extract application. This may have to be reason why copious amount of the decoction of this herb has to be taken by individuals in order for it to achieve its maximal effects.

Furthermore, the traditional medical practitioners usually prescribe this plant with other herbs such as Khaya spp, native natron and other substances. These may have the effect of enhancing its blood forming and or medicinal properties (Dalziel 1948, Watt and Brayer-Brandwijk, 1963, Marton, 1981). The improvement on blood parameters after use is likely to improve also upon the well being of the individual or patient thereby justifying its use as an antiabortive agent (Duke and Wain, 1981).

On the whole, further work is needed to determine the mechanism of action of this plant extract along with its various chemical components.

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