

AN INVESTIGATION OF THE EFFECTS OF *ALLIUM SATIVUM* (GARLIC) EXTRACTS ON HAEMATOLOGICAL PROFILE OF WHITE ALBINO RATS.

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Summary

The effects of aqueous extracts of *Allium sativum* on haematological parameters in rats during a 6 weeks administration of the doses of 200, 250 and 300mg/kg body weight orally was investigated. The parameters evaluated include PCV, HB, RBC and WBC. The result showed that *A. sativum* aqueous extracts produced a dose-independent significant ($P < 0.05$) increment on the haematological parameters (except WBC) when compared with that of the control rats. *A. sativum* at 200mg/kg increased PCV by 12.74% (40.1 ± 1.4 to 45.2 ± 1.1), at 250mg/kg it increased PCV by 12.97 % (40.3 ± 1.1 to 45.6 ± 1.1) and at 300mg/kg it increased PCV by 11.93% (41.0 ± 0.7 to 45.9 ± 0.8). *A. sativum* at 200mg/kg increased RBC by 8.98% (7.24 ± 0.1 to 7.89 ± 0.2), at 250mg/kg it increased RBC by 10.31 % (7.18 ± 0.2 to 7.92 ± 0.2) while at 300mg/kg it increased RBC by 8.9 % (7.19 ± 0.2 to 7.83 ± 0.2). Also, *A. sativum* at 200mg/kg increased WBC by 48.4% (10.2 ± 0.7 to 15.1 ± 0.3), at 250mg/kg it increased WBC by 54.8% (10.0 ± 0.5 to 15.5 ± 0.2). and at 300mg/kg it increased WBC by 54.6% (10.2 ± 0.4 to 15.7 ± 0.2). *A. sativum* at 200mg/kg increased HB by 12.52% (12.50 ± 0.2 to 15.19 ± 0.3), at 250mg/kg it increased HB by 23.78 % (12.54 ± 0.2 to 15.51 ± 0.2). and at 300mg/kg it increased HB by 23.06 % (12.66 ± 0.2 to 15.58 ± 0.2). The result of this study suggested that *A. sativum* extracts studied showed positive haematological activities in rats which should warrant its consideration in the management of anaemia and immunity dependent disorders such as AIDS.

(Keywords: *Allium sativum*., Albino rats, Aqueous extracts, Haematology)

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Introduction

The use of plants by man for the management of various diseases has been in practice and is very popular in many developing countries of the world for over a long time (1,2). The annual sale of medicinal herbs and related commodities among the United States population exceeds two billion dollars (3). In Africa especially in the tropical areas, several factors such as poverty and illiteracy militate against availability and accessibility of western medical services hence the need to shift to the use of herbal preparations. Herbal preparations are effective, relatively cheap, has less side effects and low toxicity hence its use is highly attractive among people in the developing countries. Increasing interests in medicinal herbs has increased scientific scrutiny of their therapeutic potential and safety thereby providing physicians with data to help patients make wise decisions about their use (4). *A. sativum*, a member of the lily family, is most commonly used world wide for flavourful cooking (5). It has been used effectively as food and medicine for many centuries (3). *A. sativum* and its preparations have been widely recognized as agent for prevention and treatment of cardiovascular and other metabolic diseases such as atherosclerosis, hyperlipidemia, thrombosis, hypertension and diabetes (6). There is lack of on the haematological effects of this medicinal plant hence this study on its effects in this animal model. It is a great challenge for scientists all over the world to make proper use of *A. sativum* and enjoy its maximum beneficial health effect as it is one of the cheapest ways to management various disease. Allicin is the principal bioactive compound, present in aqueous *A. sativum* extract or homogenate (6). In view of the varied therapeutic application of *A. sativum* this present study was designed to investigate the haematological effects of increasing dosage of *Allium sativum* aqueous extracts on *R. norvegicus vis-à-vis* haematological parameters such as haemoglobin concentration, packed cell volume, white blood cell count and red blood cell count for possible administration in the management of anaemia and immunity dependent disorders such as AIDS.

Materials and Methods

Plant Material

The *A. sativum* used for the experiment were bought from the Ogige market, Nsukka, Nigeria. The plants were identified (7) to species level at the Herbarium Unit, Department of Botany University of Nigeria, Nsukka where voucher specimen were kept.

Animal Model

Thirty six (36) adult white wistar strain male albino rats (*R. norvegicus*) weighing 200 to 250g, bred in the animal house of the Faculty of Veterinary Medicine, University of Nigeria, Nsukka were used for the study. They were fed *ad libitum* with 30% crude protein (Guinea feed) commercial feed. They were allowed to acclimatize under standard photoperiodic condition in a clean rat cage in the Postgraduate Research Laboratory, Department of Zoology, University of Nigeria, Nsukka. All animals were maintained under the standard laboratory condition for temperature ($26 \pm 2^{\circ}\text{C}$) and light (12 hours day length) and were allowed free access to food and water.

Preparation of Plant Extract.

Fresh health plant each of *A. sativum* (2000g) were washed, cut into small pieces and homogenized in a waring blender. The resulting mixture was soaked in 2L of distilled water. The mixture was allowed to stand for twenty four hours with intermittent shaking. Following filtration, the filtrate was heated to dryness in a water bath and the weight of the crude extract determined. The extracts were kept in refrigerator (4⁰C) thereafter. The extract was later reconstituted in normal saline (0.85% NaCl) at a concentration of 1g/ml before administration.

Experimental Design

The study was carried out on male rats for six weeks and blood sample were collected from the eye of the rats. All haematological parameters assessed were determined before the extract treatments of the animals (initials) and subsequently evaluated weekly for six weeks. The experimental design was the three by three Latin square design. The Thirty - six male rats used were divided into two major groups:

Group I: nine rats (control).

Group II: twenty-seven rats.

The group I rats received 1.0ml of normal saline intraperitoneally daily.

The Group II were divided into 3 replicates (II₁, II₂, II₃) respectively, each replicate (3 rats each) received 200 mg/kg, 250 mg/kg or 300 mg/kg of *A. sativum* aqueous extracts intraperitonially..

Evaluation of Haematological Parameters

Routine haematological methods involving the use haematocytometer, microhaematocrit centrifuge and sahlis method were used to determine RBC, WBC, PCV and HB estimation (8)

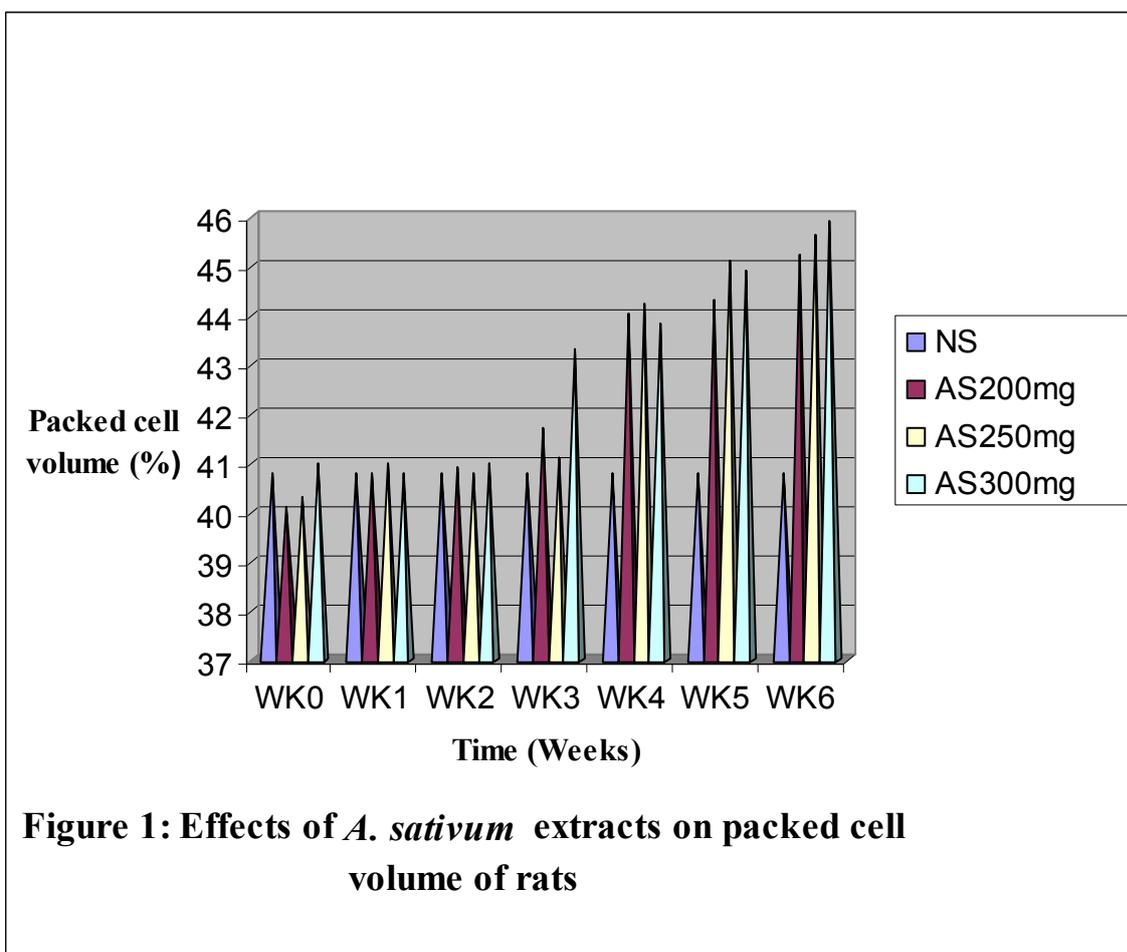
Data Analysis

The data collected were pooled and analyzed for their central tendencies using descriptive statistic, values were expressed as mean \pm standard deviation of the observations. F-LSD was employed to test the significant differences ($P < 0.05$) among treatment means. All analyses were performed using (9) statistical software package for windows.

Results

Packed Cell Volume (PCV)

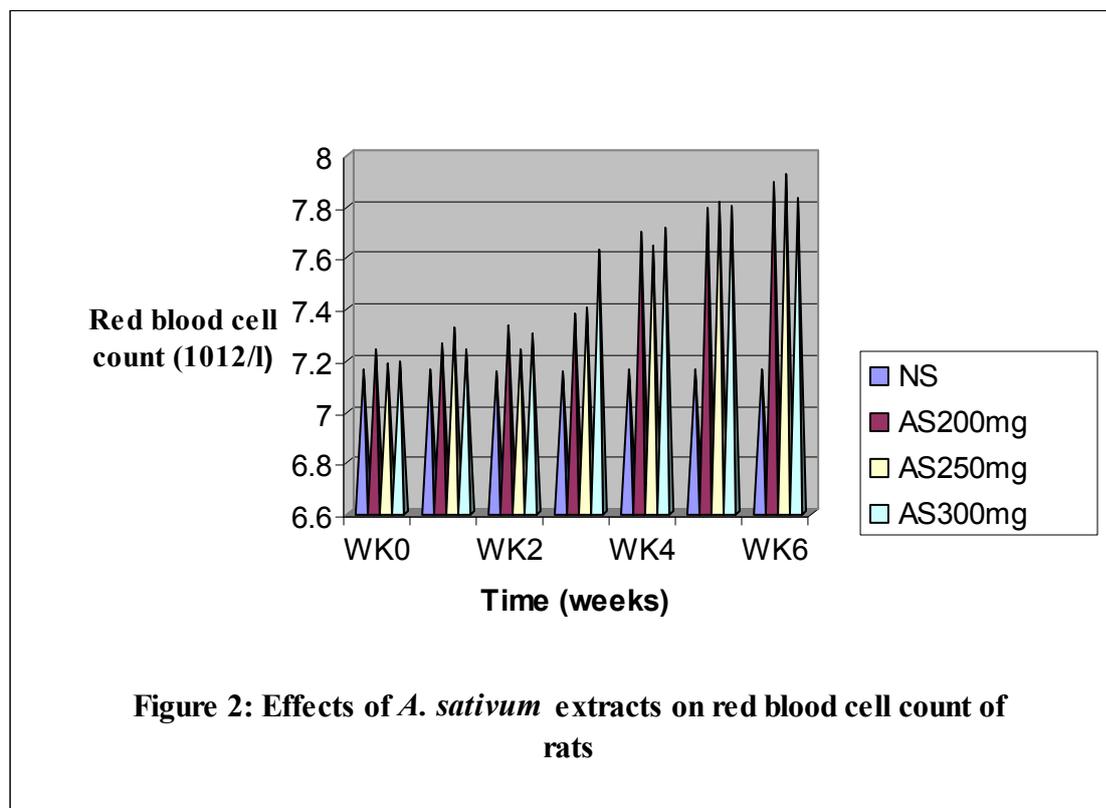
The effects of the increasing dosage of *A. sativum* extracts on PCV compared with normal saline treated rats during the 6 weeks experimental period indicated that *A. sativum* at 200mg/kg increased PCV by 12.74% (40.1 \pm 1.4 to 45.2 \pm 1.1), at 250mg/kg it increased PCV by 12.97 % (40.3 \pm 1.1 to 45.6 \pm 1.1) and at 300mg/kg it increased PCV by 11.93 % (41.0 \pm 0.7 to 45.9 \pm 0.8) (Figure 1). Normal saline at 1ml/kg bw ip had no effect on PCV. These values were statistically different when their F-LSD value (0.878) was used to test for significant differences among treatment means ($P < 0.05$).



Key: Values given represent the Mean \pm SD of 9 observations. NS = Normal saline represents Control, AS = *Allium sativum*, P < 0.05, F-LSD = 0.878.

Red Blood Cells (RBC)

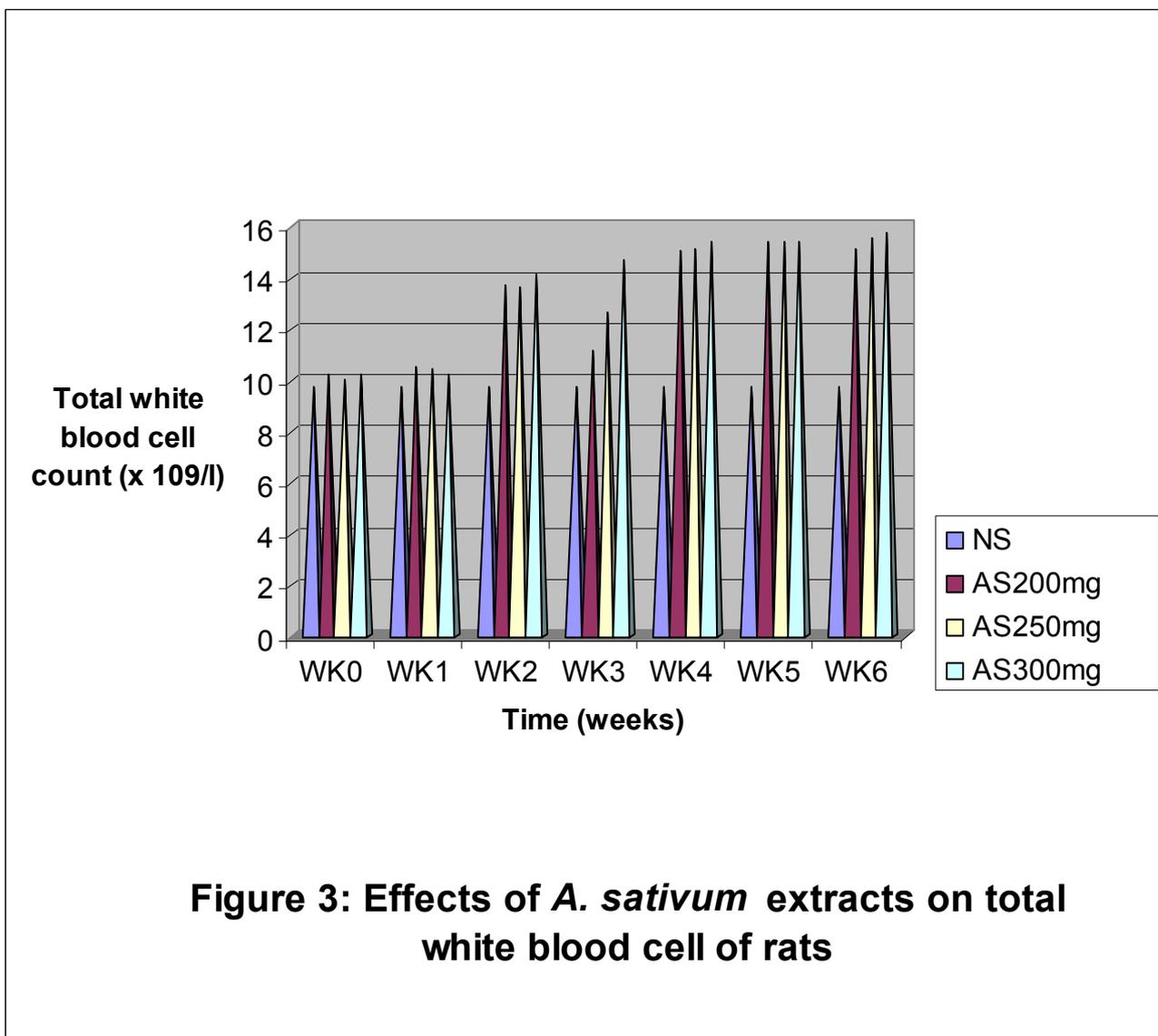
The effects of the increasing dosage of plant extracts on RBC count compared with normal saline treated rats during the 6 weeks experimental period indicated that *A. sativum* at 200mg/kg increased RBC by 8.98% (7.24 \pm 0.1 to 7.89 \pm 0.2), at 250mg/kg it increased RBC by 10.31 % (7.18 \pm 0.2 to 7.92 \pm 0.2) and at 300mg/kg it increased RBC by 8.9 % (7.19 \pm 0.2 to 7.83 \pm 0.2) (Figure 2). Normal saline at 1ml/kg bw ip had no effect on RBC. These values were statistically different when their F-LSD value (0.138) was used to test for significant differences between the means at (P < 0.05).



Key: Values given represent the Mean \pm SD of 9 observations. NS = Normal saline represents Control, AS = *Allium sativum*, $P < 0.05$, F-LSD = 0.138.

White Blood Cells (WBC)

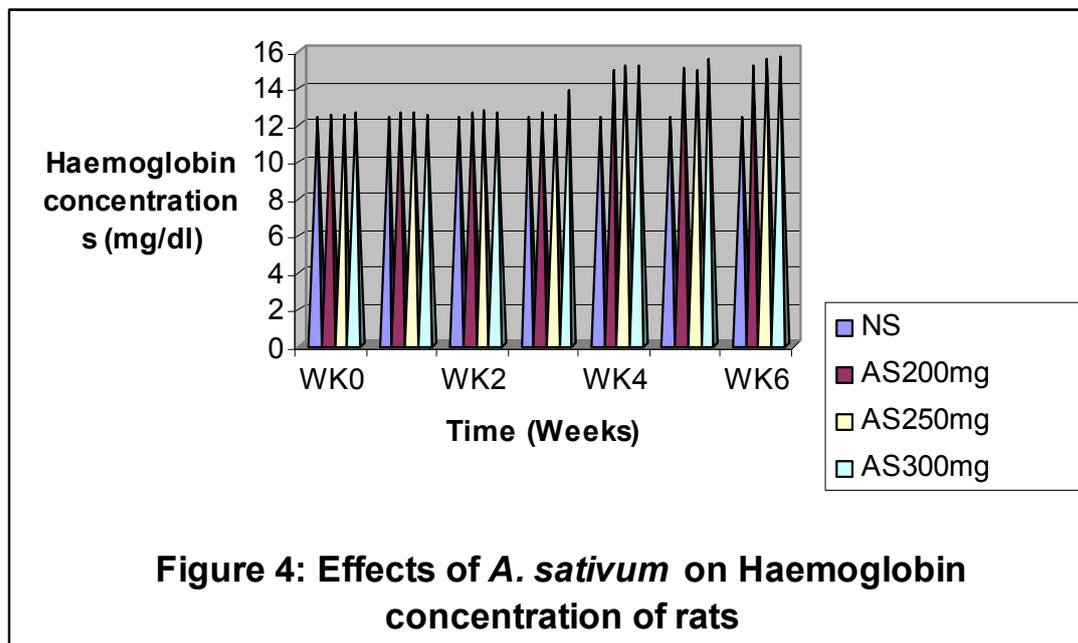
. The effects of the increasing dosage of plant extracts on WBC compared with normal saline treated rats during the 6 weeks experimental period showed that *A. sativum* at 200mg/kg increased WBC by 48.4% (10.2 ± 0.7 to 15.1 ± 0.3), at 250mg/kg it increased WBC by 54.8% (10.0 ± 0.5 to 15.5 ± 0.2) and at 300mg/kg it increased WBC by 54.6% (10.2 ± 0.4 to 15.7 ± 0.2) (Figure 3).. Normal saline at 1ml/kg bw ip had no effect on WBC. These values were statistically different when their F-LSD value (0.183) was used to test for significant differences between the means at ($P < 0.05$).



Key: Values given represent the Mean \pm SD of 9 observations. NS = Normal saline represents Control AS = *Allium sativum*, $P < 0.05$, F-LSD = 0.387.

Haemoglobin Concentration (HB)

. The effects of the increasing dosage of plant extracts on HB concentration compared with normal saline treated rats during the 6 weeks experimental period indicated that *A. sativum* at 200mg/kg increased HB by 12.52% (12.50 \pm 0.2 to 15.19 \pm 0.3), at 250mg/kg it increased HB by 23.78 % (12.54 \pm 0.2 to 15.51 \pm 0.2) and at 300mg/kg it increased HB by 23.06 % (12.66 \pm 0.2 to 15.58 \pm 0.2) (Figure 4). Normal saline at 1ml/kg bw ip had no effect on HB. These values were statistically different when their F-LSD value (0.183) was used to test for significant differences between the means ($P < 0.05$).



Key: Values given represent the Mean \pm SD of 9 observations. NS = Normal saline represents control AS = *Allium sativum*, $P < 0.05$, F-LSD = 0.183.

Discussion

Blood is a good indicator to determine the pathological and physiological status of man and animal. Assessment of haematological parameters can be used to determine the extent of deleterious effect of foreign compounds including plant extracts on the blood. The significant effect of the *A. sativum* extracts on RBC, Hb and PCV implies that there was a change in the oxygen – carrying capacity of the blood and the amount of oxygen delivered to the tissues, since RBC and Hb are very important in transferring respiratory gases (10). This suggested that the *A. sativum* extracts have the potential to stimulate erythropoietin release in the kidney which is the humoral regulators of RBC production (11, 12). WBC were significantly improved an indication of a boost on the immune system by the *A. sativum* extracts. My findings corroborate previous researches (13,14) on effects of garlic extracts on WBC. Extracts increased WBC suggesting it may contain some bioactive agents that could cause improved production of white blood cell. This observation may partly explain the role garlic in activating the natural killer cells, the function of T – lymphocytes and the level of interleukin –2 (15). The increase in WBC following garlic feeding confirms the anti- infection properties of garlic. It is thus possible that garlic components competes with Hb in RBC for oxygen resulting in hypoxia which then stimulates Hb synthesis and production of RBC. It is also possible that the end product of garlic metabolism in the body stimulates the kidney directly to cause formation and secretion of erythropoietin (16).

Conclusions

The increase in Hb, RBC and PCV observed in this study suggested that *A. sativum* extracts may be pursued for their clinical relevance in the management of anaemia and immunity dependent disorders like AIDS..

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