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**NIGERIAN JOURNAL OF BIOCHEMISTRY AND MOLECULAR
BIOLOGY, VOLUME 16 (NUMBER 1) 2001.**

TABLE OF CONTENTS

	Pages
1. Comparative analysis of DNA fragment length polymorphs at a β - globin gene locus of human, rhesus monkey and guinea pig. — B. A. Iwalokun, T. A. Adewole, A. A. Adeiga, N. N. Odunukwe and E. O. Akinrimisi.	1
2. Phytochemical analyses and antimicrobial activity of <i>Khaya senegalensis</i> — A. A. Jigam and W. O. Atunde.	7
3. Comparative studies of the effects of pre- treatment of three agrowaste on cellulase production by <i>Aspergillus niger</i> Sl.L — A. E. Abu, D. A. Ameh, P. C. Onyenekwe, A. S. Agbaji, S. A. Ado and A. R. Nwaeze.	13
4. Correlation between clinical and theoretical mechanistic biochemistry (TMB)- predicted side – effects of artesunate in malariology. — D. A. Akintonwa and E. N. U. Ezedinachi.	19
5. Post harvest levels of trypsin inhibitors and β - carotene contents of some sweet potato varieties. — E. Onyike and K. R. Kongbeyin.	25
6. The action of ripe fruit juices on hemoglobin polymerization, Fe^{2+} / Fe^{3+} Ratio and lactate dehydrogenase activity of sickle cell (HbSS) blood. — G. I. Ekeke, A. A. Uwakwe and R. Nwaoguikpe.	31
7. Influence of chloroquine phosphate on protein - undernutrition-induced hyperglycaemia in rats. — G. A. Adenuga, S. J. Odukoya, A. A. Adesanya, S. K. Adefolarin and A. A. Adedeji.	37
8. Studies on some antinutritive factors and <i>in vitro</i> protein digestibility of <i>Thaumatococcus danielli</i> (Benth) waste. — B. O. Elemo, G. N. Elemo, O. O. Agboola and A. B. Oyedun.	43

- 9 The amino acid composition of *Cassia tora* and *Cassia occidentalis* (Leguminosae, subfamily *caesalpinioideae*).
 ___ **J. T. Ayodele, C. A. Etonihu and T. O. Olagbenro.** 47
- 10 Effect of different nitrogen sources on the growth and polygalacturonase activity of *Phoma sorghina*..
 ___ **F. A. Akinyosoye and G. Oboh.** 51
- 11 Activity and thermostability characteristics of β -amylase obtained from heat – shocked cells of *Bacillus polymyxa*.
 ___ **J. O. Ajele and V. O. Aladenola.** 57
- 12 Effect of whole garlic treatment on blood and erythrocyte glutathione (GSH) concentration in *Trypanosoma brucei brucei* infection of rats.
 ___ **A. Abubakar, S. B. Iliyasu, N. A. Onyekwelu , D. Y. Bot and D. O. Rotimi.** 63
13. Effect of aqueous leaf extract of *Ficus exasperata* (Vahl) on normal and alloxan- diabetic rats.
 ___ **R. Nimenibo - Uadia and A. U. Osagie.** 67
14. The use of zinc iontophoresis in the treatment of indolent bacteria colonized skin ulcers.
 ___ **G. A. Sanjo, S. I. Akande and A. O. Oluwale.** 73
- 15 Chemical and sensory evaluation of melon fungus (*Pleurotus tuber regium*) and melon fungus cake.
 ___ **E. N. Onyeike and F. C. Ehirim.** 77
- 16 Biological activities of *Phyllanthus amarus* extracts on Sprague – dawley rats.
 ___ **O. O. Oyedapo.** 83
- 17 Isolation and partial characterization of carbohydrate components of *Thaumatococcus danielli* (Benth)
 ___ **B. O. Elemo, O. B. Adu and A. M. Alabi.** 87

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Effect of Whole Garlic Treatment on Blood and Erythrocyte Glutathione (GSH) Concentration in Acute *Trypanosoma brucei brucei* Infection of Rats.

*A. Abubakar¹, S.B. Iiyasu¹, N.A. Onyekwelu¹, L.O. Mgbojikwe², D.Y. Bot¹ and D.O. Rotimi²

1. Biochemistry and Chemotherapy Division, Nigerian Institute for Trypanosomiasis Research, P.M.B. 03, Vom, Plateau State.
2. Federal College of Animal Health and production Technology, National Veterinary Research Institute Vom, Plateau State.

ABSTRACT

Studies on the effect of whole garlic treatment on some blood parameters and glutathione (GSH) concentration in rats experimentally infected with *Trypanosoma brucei brucei* were carried out. Some rats were treated orally with 50, 150 and 200mg garlic per kilogramme body weight from day 2 post infection (Pi). Blood and erythrocyte GSH concentration, red blood count (RBC), haemoglobin concentration (Hb) and packed cell volume (PCV) were determined on day 7 post infection and treatment. The results showed a significant increase in the Hb concentration, RBC count and PCV of garlic treated rats when compared to infected and untreated rats ($P < 0.05$). There was no significant difference in the blood GSH levels of garlic treated rats ($P > 0.05$) whereas the levels of erythrocyte GSH dropped significantly at 150 and 200mg garlic per kilogramme body weight ($P < 0.05$). It seems, therefore, that the mechanism by which garlic alleviates *T. b. brucei*, induced anaemia could be by other means than reducing peroxide load from the blood.

INTRODUCTION

The anaemia that occurs during trypanosomiasis is multi-factorial. Mechanisms such as haemolysis (Anosa, and Kaneko, 1983), haemodilution (Whitelaw *et al*, 1980) and dyshaemopoiesis (Dodd *et al*, 1988) have been proposed. Ameh (1984) reported that the susceptibility to oxidative haemolysis increased in *Trypanosoma b. gambiense* infected rats and Igbokwe *et al* (1994) showed an increased susceptibility of erythrocytes to *in vitro* peroxidation in *T. b. brucei*, infected mice. Enormous amounts of hydrogen peroxide was produced by *T. b. brucei* organisms (Meshnick *et al*, 1977) and macrophages activated by *T. b. brucei* also produced superoxide anions and hydrogen peroxide after respiratory burst (Vray *et al*, 1991). Glutathione is the only non-protein thiol in the erythrocyte and liver of animals involved in neutralizing endogenous peroxides (Kosower and Kosower, 1978).

Garlic (*Allium sativum* linn) is a common foodstuff ascribed with several medicinal properties. The oral administration of whole garlic to *T. b. brucei* infected rats has been shown to prevent the rise in FFA levels, increased serum albumin and improved the PCV values (Abubakar *et al*, 2000).

In the present study the effect of whole garlic administration on haematological parameters, erythrocyte and blood GSH concentration in *T. b. brucei* infected rats were determined.

MATERIALS AND METHODS

Twenty-four male albino rats weighing between 52 - 65g were used. They were given grower's mash and water *ad libitum*.

The garlic cloves were obtained from Jos main Market. The dry sheaths were removed leaving the succulent fresh bulbs, which were oven dried at 40°C for about 18 hours. The dried garlic was then ground into fine powder before use.

The rats were divided into 6 groups of 4 rats each. Groups I - IV rats were all inoculated with 0.05ml normal saline containing 8×10^5 *T. b. brucei* intraperitoneally. Treatment of rats in groups II - V commenced on day 2 post inoculation with establishment of infection. Doses of 50, 150, 200 and 200mg/kg body weight were given to the respective groups daily for 5 consecutive days. Rats in group VI served as uninfected and untreated control while group I was untreated.

Parasitaemia was estimated daily from the tail blood using wet blood film by the matching method technique of Herbert and Lumsden (1976). The rats were sacrificed on day 7 Pi by cardiac puncture. The PCV was determined by the microhaematocrit method, while the RBC count and haemoglobin concentration were determined by haemocytometer and cyanomethaemoglobin methods respectively

*Corresponding Author

(Schalm *et al*, 1975). Blood glutathione level was measured using the method of Beutler *et al*, (1963). The erythrocyte glutathione (GSH) concentration was obtained by calculation using blood GSH concentration and PCV (Igbokwe *et al*, 1998).

The data were summarized as mean \pm standard deviation (SD) and paired comparisons between means was assessed by student's t-test (Chatfield, 1983).

KEY

- I. Infected and untreated
- II. Infected and treated with 50mg/kg body weight
- III. Infected and treated with 150mg/kg body weight
- IV. Infected and treated with 200mg/kg body weight
- V. Uninfected and treated with 200mg/kg body weight
- VI. Uninfected and untreated.

RESULTS

All the infected rats were parasitaemic on day 2 Pi. They reached peak parasitaemia by day 6 and one rat in group I died on day 7 Pi before sacrifice. The mean values of all parameters measured are presented in Fig 1. The PCV values, RBC count and haemoglobin concentration of treated rats in groups III and IV improved significantly when compared to those in group I ($P < 0.05$). The blood GSH levels of all the groups were not affected ($P > 0.05$), whereas the erythrocyte GSH levels of infected and treated groups significantly decreased as compared to those of group I ($P < 0.05$).

DISCUSSION

It has been an established fact that the measurement of anaemia gives a reliable indication of the disease status (Murray, 1979) and productive performance (Morrison *et al*, 1981) of trypanosome-infected animal. Several mechanisms of anaemia that occur during trypanosomiasis have been proposed and oxidative injury of red blood cells is one of them, which require further investigation.

The significant decrease observed in haematological parameters of infected and untreated rats (Fig 1.) is consistent with other findings as reviewed by Anosa (1988). As a result of massive parasitaemia and increased destruction of trypanosomes, it is also possible that the hydrogen peroxide and superoxide anions produced could have exceeded the GSH levels which is responsible for preventing the peroxidation of erythrocyte and consequently leading to anaemia. This observation is suspected based on the fact that the erythrocyte GSH increased in this group I rats which is in conformity with the findings of Igbokwe (1998).

However, with garlic treatment, the PCV, RBC count and haemoglobin concentration improved significantly ($P < 0.05$) particularly at 150 and

200mg/kg body weight (Fig 1). The garlic treatment has no effect on blood GSH levels when compared to infected and untreated rats (Fig 1.) A significant decrease in the erythrocyte GSH levels of infected and treated rats was observed. Igbokwe *et al* (1996a) showed that the PCV had a direct relationship with erythrocyte GSH in healthy cattle. So the improved haematological parameters and decreased erythrocyte GSH levels in garlic treated rats may have suggested the reduced chances of the emergence of immature and young erythrocyte into circulation which is associated with increased GSH concentration (Turker and Kigour, 1973) as observed in infected and untreated rats. Further studies on *T. vivax* infected cattle have shown that the erythrocyte GSH tended to increase at lower PCV (Igbokwe *et al*, 1996b). Apparently, the effect of garlic administration to *T. b. brucei* infected rats in this study seems to agree with this report.

CONCLUSION

The administration of garlic to *T. b. brucei* infected rats prevented the anaemia by improving the PCV, Hb concentration and RBC count and also obscuring the emergence of young and immature erythrocyte thereby reducing the level of erythrocyte GSH.

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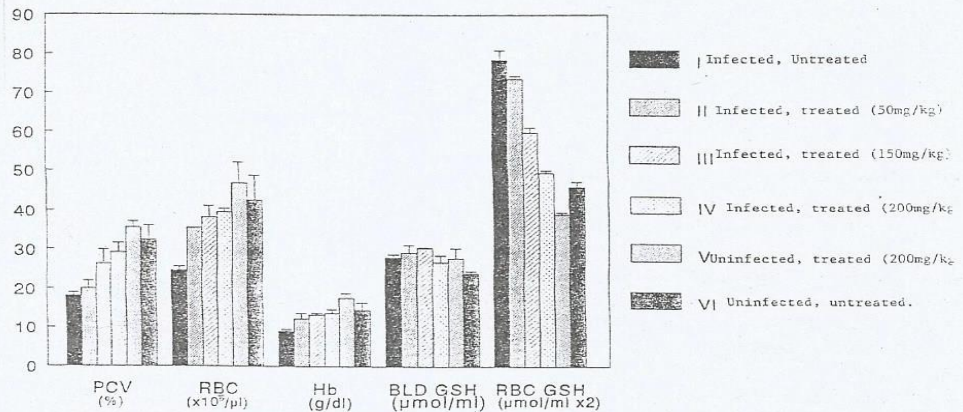


FIGURE 1. MEAN ERYTHROCYTE GSH AND SOME HAEMATOLOGICAL PARAMETERS IN *T. B. BRUCEI* INFECTED RATS TREATED WITH DIFFERENT DOSES OF GARLIC.