



## Evaluation of hematological and Biochemical changes induced by garlic (*Allium Sativum*) in Rats

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### Abstract

The effect of *Allium sativum* on the blood cells, platelet and electrolytes was investigated in twelve (12) wistar rats. The experiment lasted for four weeks excluding one weeks of acclimatization. At the end of the experiment, the animals were starved overnight, anesthetized, and the blood sample collected through the cardiac puncture. Blood was collected into an EDTA and plain bottle for hematological parameters and electrolyte analysis respectively. The evaluated parameters were; Erythrocyte sedimentation rate (ESR), White blood cell count (WBC), Hemoglobin (Hb), platelet count, Mean corpuscular hemoglobin (MCH), monocyte, basophil, eosinophil, Packed cell volume (PCV), Mean corpuscular hemoglobin concentration (MCHC), neutrophil, lymphocyte, sodium, potassium, chloride, and bicarbonate. The result obtained showed that *Allium sativum* at a low doses significantly affected white blood cells count (WBC), platelet, monocyte, Basophile,  $\text{Na}^+$ ,  $\text{HCO}_3^-$  ( $P < 0.05$ ). Other parameters were not significantly affected. It was concluded that consumption of *Allium sativum* in minimal dose affects the amount of circulating blood cells hence increases body defense. Garlic demonstrated potential benefits by causing the increase in some blood parameters implicated in promoting good health, maintaining blood factors required for body defense and helps maintain electrolyte balance in the rat's system.

### 1 Introduction

The biological response of *Allium sativum* (Garlic) has been largely attributed to stimulation of immune function and reduction of risk factor for cardiovascular diseases and cancers<sup>1</sup>. Garlic (*Allium sativum*), one of the most researched herbal remedies, it holds an important place in history, employed to prevent a variety of diseases, some of the numerous diseases include; heart diseases and a host of other disorders<sup>1</sup>. Various studies have shown that garlic has antibacterial, antiviral and antifungal activity. Some early investigations in humans have shown possible cardiovascular benefits of garlic<sup>2</sup>. Treatment with garlic extracts was found to enhance the activation of natural killer cells, the function of T-lymphocytes and the level of interleukin – 2<sup>27</sup>. Also *in vitro* and *in vivo* studies showed that aged garlic extracts stimulate immune functions<sup>8</sup>. Garlic extracts was used in the treatment of a wide range of disorders in the

past<sup>11</sup>. It was shown that garlic oil is agile against fat infiltration of the liver<sup>28</sup>. It was reported that garlic preparation showed significant decrease in diastolic blood pressure in hypertensive patients<sup>17</sup>. Hematological parameters are common diagnostic tools used in evaluating the current health status of individuals<sup>3</sup>. Hematological parameters are closely related to the response of animal to the environment<sup>4</sup>. Electrolytes are the salts and metallic components that are dissolved within the blood serum. Electrolytes of greatest clinical importance includes; sodium, potassium, chloride, bicarbonate, phosphorus, and calcium. Electrolytes are involved in most of the body's daily functions.

This study, therefore, investigated the effects of the medicinal plant "*Garlic*" on varied hematological parameters and serum electrolyte to possibly resolve the claim by folk that garlic is an effective herbal medicine for the treatment of some diseases and restoration of electrolyte imbalance.

**2 Materials and Method**

*2.1 Preparation of garlic juice*

Fresh garlic cloves were obtained from a local market, peeled, washed, crushed and mixed with distilled water. For the low dose, 150g of garlic was crushed and mixed with 300ml of distilled water. For the high dose, 150g of garlic was crushed and mixed with 150ml of distilled water. The juices were sieved out from the mixture. The garlic juice was preserved in the refrigerator throughout the experimental period.

*2.2 Experimental design*

Twelve male wistar rats were used, grouped randomly into three groups; control (group A) and group B and group C garlic fed (4 rats in each group). The animals weighed between 120g -175g, at the start with the experiment which lasted for four weeks excluding the one weeks of acclimatization. The control rats (group A) were fed with rat chow and water, while the group B (low dose) test rats were fed with rat chow, water, and garlics extract (0.5ml per rat per day, via 5ml oral feeding tube) and the group C (high dose) test rats were fed with rat chow, water, and

garlic extract (1ml per rat per day, via 5ml oral feeding tube). At the end of the experiment, the animals were starved overnight, anesthetized, and the blood sample collected through cardiac puncture. The hematological parameters (complete blood count) were analyzed using coulter HMX Hematology Analyzer. Serum electrolytes were determined by standard flame photometry. Chloride was assessed by the method of Schales and Schales (1941) <sup>18</sup> (mercurimetric determination of chloride), and bicarbonate according to Toro and Ackermann (1975) <sup>20</sup>

*2.3 Statistical analysis*

The experimental results were presented as mean ± SEM for four animals in each group. Data was analyzed using one way ANOVA. P Value < 0.05 was adjudged to be statistically significant.

**3 Results**

The mean concentrations of hematological parameter following administration of freshly prepared Garlic (*Allium sativum*) are represented in table 1 and table 2, respectively.

**Table 1: Levels of WBC, Neutrophile, lymphocytes, Monocytes, Basophile and Eosinophil in animals**

Group	WBC	Neutro.	Lympho.	Mono.	Baso.	Eosino.
Control	5.88±0.65	54.5±2.63	43.5±2.62	1.5±0.29	0.0±0.0	0.50±0.29
High dose	7.70±1.08	62.5±3.40	35.8±3.71	1.00±0.41	0.33±0.24	0.33±0.24
Low dose	8.05±0.43*	54.5±3.86	45.0±4.36	0.25±0.25*	0.0±0.0*	0.25±0.25

\*P < 0.05 when compared with the control.; Values are expressed as the Mean ± SEM

**Table 2: Levels of PVC, Hb, Platelet, ESR, MCHC and MCH in animals**

Group	PCV	Hb	Platelet	ESR	MCHC	MCH
Control	42.25±1.11	13.95±0.46	140.8±25.9	4.50±0.65	341.25±11.05	29.75±0.58
High dose	46.5±1.44	15.65±0.36	136.3±8.5	3.80±0.25	330.38±1.95	30.03±0.51
Low dose	44.25±1.89	14.55±0.66	71.8±16.2*	5.0±0.91	328.68±1.32	28.90±0.72

\*P < 0.05 when compared with the control.; Values are expressed as the Mean ± SEM

In Packed cell volume (PCV), there was no significant difference observed between the values of the control (42.25±1.11) and that of the high-dose group (46.5±1.44), low dose group (44.25±1.89) at P> 0.05. In Hemoglobin concentration, there was no significant difference observed between the values of the control (13.95±0.46) and that of the high dose (15.65±0.36), low doses group (14.55±0.66) at p>0.05. In Erythrocyte sedimentation rate (ESR), there was no significant difference observed between the values of the control group (4.50±0.65) as compared with the high dose group (3.80±0.25) and low dose group (5.0±0.91) p>0.05. In Mean corpuscular hemoglobin concentration (MCHC), there was no significant difference observed between the mean values of the control dose group (341.25±11.05), when compared high-dose h the high dose group (330.38±1.95) and the low dose group (328.68±1.32) at

p>0.05. In Mean corpuscular hemoglobin (MCH), there was no significant difference observed between the mean values of the control group (29.75±0.54), when compared with the high dose group (30.03±0.51) and low dose group (28.90±0.72) at p>0.05.

In Neutrophil, there was no significant difference observed between the values of the control dose group (54.5±2.63) when compared with that of the high dose group (62.5±3.40) and the low dose group (54.5±3.86) at p>0.05. In Lymphocyte, there was no significant difference observed between the values of the control dose group (43.5±2.62) when compared with the values of high dose group (35.8±3.71) and the low dose group (45.0±4.36) at p>0.05. In Eosinophil, there was no significant difference observed between the values of the control group

(0.50±0.29) and the high dose group (0.33±0.25), and low dose group (0.25±0.25) at  $p>0.05$ . In Platelet, there was no significant difference observed between the values of the control group (140.8±25.9) and the high dose group (136.3±8.5)  $p>0.05$  but when compared with the values of the low dose group (71.8±16.2), it was significantly lower  $p<0.05$ .

In White blood cell count, there was no significant difference observed between the mean values of the control group (5.88±0.65) and the high dose group (7.70±1.08)  $p>0.05$  but when compared with the values of the low dose group (8.05±0.48), it was significantly higher  $p<0.05$ . In Monocyte, there was no significant difference observed between the values of the control group (1.5±0.29) and the high dose group (1.00±0.41)  $p>0.05$  but when compared with the values of the low dose group (0.25±0.25), it was significantly lower  $p<0.05$ . In Basophil, there was no significant difference observed between the values of the control group (0.0±0.0) and the high dose group (0.33±0.24)  $p>0.05$  but when compared with the values of the low dose group (0.0±0.0), it was  $p<0.05$ .

Table 3 shows the mean values of serum electrolyte levels in the control group and the test groups. In Sodium ion ( $\text{Na}^+$ ) level, there was no significant difference observed between the values of the control group (123.2±43.26) and the high dose group (75.5±20.16)  $p>0.05$  but when compared to the values of the low dose group (259.00±26.95), it was significantly higher  $p<0.05$ . In Bicarbonate ion ( $\text{HCO}_3^-$ ) level, there was no significant difference observed between the values of the control group (20.53±7.21) and the high dose group (12.43±3.38)  $p>0.05$  but when compared with the values of the low dose group (43.15±4.50), it was significantly higher  $p<0.05$ . In Potassium ( $\text{K}^+$ ) level, there was no significant difference observed between the values of the control group (8.4±2.28) and the high dose group (13.15±0.72) and low dose group (9.7±1.71)  $p>0.05$ . In Chlorine ion ( $\text{Cl}^-$ ) level, there was no significant difference observed between the values of the control group (81.43±28.90) and the high dose group (61.38±9.24) and low dose group (44.30±17.70)  $p>0.05$ .

**Table 3: Serum electrolyte levels of control and test wistar rats**

Group	$\text{Na}^+$ (mg/dl)	$\text{Cl}^-$ (mg/dl)	$\text{HCO}_3^-$ (mg/dl)	$\text{K}^+$ (mg/dl)
Control	123.2±43.26	81.43±28.90	20.53±7.21	8.4±2.28
High dose	75.5±20.16	61.38±9.24	12.43±3.38	13.15±0.72
Low dose	259.00±26.95*	44.30±17.70	43.15±4.50*	9.7±1.71

\* $P < 0.05$  when compared with the control. Values are expressed as the Mean ± SEM

#### 4 Discussions

This study was carried out to access the effects of garlic- *Allium sativum* on some hematological parameters and Electrolyte concentration on wistar rats. Hematological parameters are closely associated with the reaction of animals to environment<sup>4</sup>. Changes in hematological parameters may be due to modification in cellular integrity membrane permeability and metabolism or even exposure to toxic chemicals<sup>5</sup>. The result obtained in this study showed that Neutrophil, lymphocytes, Eosinophil's, PCV, Hb, ESR, MCHC, MCH in both control and test groups (high dose and low dose) were not statistically different; however, there was significant difference in the mean values of Platelet, WBC, Monocyte and Basophile concentration between the control group and the low dose groups. The observation of the study supports the findings of Sumiyoshi (1997)<sup>8</sup> and Oluwole (2011)<sup>10</sup> that garlics stimulate immune functions in rats. This observation may partly explain the role of garlic in activating the natural killer cells, the function of T-lymphocytes and the level of interleukin – 2 Tang et al (1997)<sup>27</sup>.

Furthermore, there was significant difference between the values of control and the low dose group for the electrolyte concentration of Sodium and Bi- carbonate ( $\text{Na}^+$  and  $\text{HCO}_3^-$ )

$p<0.05$ , but the other electrolyte concentration levels ( $\text{Cl}^-$  and  $\text{K}^+$ ) were not significantly affected  $P> 0.05$ .

#### 5 Conclusion

Garlic has been found to possess antibiotic action by increasing white blood cell count, which may enhance immune system when administered in low quantity. Garlic demonstrated potential benefits by causing the increase in some blood parameters implicated in promoting good health and maintaining blood factors required for body defense and may contribute to the maintenance of electrolyte balance.

#### 6 Conflict of interest

None

#### 7 Authors' contributions

AKE and NBU: Concept, Data collection, Data analysis

AKE and EHO: Draft manuscript, Final manuscript

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