

Effects of Aqueous Extract of Garlic (*Allium sativum*) on Blood Parameters in Adult Wistar Rats (*Rattus norvegicus*)

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ABSTRACT: The biological responses of *Allium sativum* (Garlic) have been largely attributed stimulation of immune function and reduction of risk factors for cardiovascular diseases and cancer. The effects of *Allium sativum* on blood cells and platelets was investigated in Wistar rats. The animals (105 – 158 g) were divided into three (3) groups; the Group A served as the control received 1 ml of distilled water, Group B received 3.5 g/kg body weight of garlic juice and Group C received 1 g/kg body weight of garlic juice extracts for 21 days of experimental period. Animals were sacrificed by cervical dislocation 24 hours after the last administration and blood was collected via the retro-orbital route with the aid of a capillary tube, into an EDTA bottle for analysis. The result shows that the juice extracts at various doses significantly ($p < 0.05$) increase the total white blood cell counts, Lymphocyte count, Neutrophils count, also there was a significant ($p < 0.05$) increase in the red blood cell count in rats treated with garlic juice. The packed cell volume of rats treated with garlic extract were significantly ($p < 0.05$) increased. There was no significant ($p < 0.05$) increase in the platelet count, monocytes count, eosinophil count, basophil count of the rats in all groups. *Allium sativum* affect the amount of circulating blood cells *Allium cepa* affect the amount of circulating blood cells thus promoting health benefits.

Keywords: *Allium sativum*, Adult wistar rat, Blood parameters, Aqueous extract.

I. INTRODUCTION

During the past decade, traditional system of medicine has become a topic of global importance. Current estimates suggest that in many developing countries, a large proportion of the population relies heavily on traditional practitioners and medicinal plants to meet primary health care needs (WHO, 1999). Many herbs have remained as an alternative to conventional therapy especially in poor areas (Sanchez *et al.*, 1994). *Allium* species is one of such plant (Banerjee and Maulik, 2002). *Allium* species such as onions and garlic are used as foodstuff, condiment, flavoring, and folk medicine (Banerjee and Maulik, 2002). This vegetable is of the onion genus '*Allium*' and is commonly referred to as garlic. The plant has many local names like Ayo in Igbo, Ayuu in Yoruba, and Tafarnuwa in Hausa. Garlic has attracted particular attention of modern medicine because of its widespread health use around the world, and the cherished belief that it helps in maintaining good health, warding off illnesses and providing more vigour. The biological responses of garlic have been largely attributed to reduction of risk factors for cardiovascular diseases and cancer, stimulation of immune function, enhanced detoxification of foreign compound, hepatoprotective effects, anti-microbial effects, antioxidant effects (Banerjee and Maulik, 2002). Ajoene, which is a secondary degradation product of alliin, is presumably the most active compound present in the bulb of garlic (Wichitl, 2004). The fresh bulb contains alliin, alicin and volatile oils (Williamson, 2003). It also contains vitamins and minerals (Gruenwald, 2004) and other trace elements like selenium and germanium are also present in *allium sativum* (Skidmore-Roth, 2003). *Allium* containing substances have antibiotic effects and antibiotics should enable the proliferation of circulating white blood cells considering that white blood cells function to protect the body from teratogens (Augusti, 1996). *Allium* species, they have been implicated in the induction of haemolytic anaemia. They contain toxic components that may damage red blood cells and provoke haemolytic anaemia accompanied by Heinz bodies in erythrocytes of animals such as cattle, water buffalos, sheep, horses, dogs and cats (Banerjee and Maulik, 2002). *Allium sativum* is a commonly utilized food supplement in individuals who suffer from a variety of cardiovascular diseases such as atherosclerosis. Approximately 4% of individuals diagnosed of cardiovascular diseases and 30% of cardiovascular patients who use herbal supplements take garlic (Yeh *et al.*; 2006). Garlic has been discovered to scavenge oxidants, increase superoxide dismutase, catalase, glutathione peroxidase, and glutathione levels, as well as inhibit lipid peroxidation and inflammatory prostaglandins. It also reduces

cholesterol build up by inhibiting 3-hydroxy-3-methylglutaryl-CoA and has been shown to inhibit LDL oxidation, platelet aggregation, arterial plaque formation, decrease homocysteine, lower blood pressure, and increase microcirculation, which is important in diabetes, where microvascular changes increase heart disease and dementia risks. Garlic may also help prevent cognitive decline by protecting neurons from neurotoxicity and apoptosis, thereby preventing ischemia- or reperfusion-related neuronal death and by improving learning and memory retention (Borek, 2006). Garlic may also possess anti-inflammatory abilities to suppress the nuclear factor-kappa B activation pathway (Aggarwal *et al.*, 2004). Hyperglycaemia an abnormally high concentration of glucose in the circulating blood, especially with reference to a fasting level has been found to be greatly reduced on administration of garlic (Pedraza-Chaverri *et al.*, 1998). Interestingly, a comparison was made between the action of garlic extract and glibenclamide, a well-known antidiabetic drug. The antidiabetic effect of the garlic was more effective than that observed with glibenclamide (Ashraf *et al.*, 2005; Pittler and Ernst, 2007). This research work is aimed at investigating the effects of *Allium Sativum* on Blood parameters of Adult Wistar Rats.

II. MATERIALS AND METHOD

Preparation of Extracts (*Allium Sativum*)

Fresh garlic was obtained from Masaka market, Abuja - Keffi way- Nasarawa State and authenticated in the Department of Biology Bingham University, Karu, Nigeria. They were weighed and then blended with water. After which they were filtered into a conical flask using a filter paper and a funnel to produce a clear juice. The extracts were freshly prepared before administration and remnants were discarded.

Experimental Animals

A total of Eighteen (18) Adult Wistar rats of both sexes weighing between 105 -158 g were used for this study. The animals were randomly divided into Three (3) groups containing six (6) rats per group. The animals were housed and bred in the well-ventilated wooden cages with metal wiring. They were allowed to acclimatize for Two (2) weeks of acclimatization. The animals were fed once daily with commercially formulated rat feed and water was given *ad libitum*. The research was carried out in accordance with the ethical rules on animals experimentation approved by the ethical committee of Bingham University.

Extract Administration

The animals in Group A were given 1ml of distilled water and serve as the control, Group B received 1.0 g of garlic juice per kilogram body weight daily and Group C received 3.5 g of garlic juice per kilogram body weight daily for 21 days of experimental period.

Animal Sacrifice and Blood Collection

Animals were sacrificed by cervical dislocation 24 hours after the last administration of the extracts, and adequate blood was drawn from the rats through the retro-orbital route with the aid of a capillary tube, into an EDTA bottle to prevent coagulation.

Analytical Procedure;

The Blood samples were analysed for total white blood cell count, lymphocyte count, red blood cell count, monocytes count, eosinophil count, basophil count, platelet count and neutrophil count using haemocytometer method as described by Schalm *et al.* (1975) and Packed cell volume was estimated using the Laboratory method, microhaematocrit method as described by Schalm *et al.* (1975).

Statistical Analysis;

The values are recorded as mean \pm SEM at $p < 0.05$ significant different using student "t" test

III. RESULT AND DISCUSSIONS

There was significant ($p < 0.05$) increase in the Total white cell count, red blood cell count, neutrophil and packed cell volume in the treatment group when compared to the control as shown in Table I, the increase was more significant in the group treated with 3.5 g/kg (Total white cell count 6.68 ± 0.33 , red blood cell count 5.59 ± 0.36 , neutrophil 30.13 ± 0.40 , packed cell volume 53.67 ± 0.56) body weight of garlic juice extract when compare with the group treated with 1.0 g/kg (lymphocyte count 68.8 ± 1.14) of the extract. PCV show significant difference in the low dose group (1.0 g/kg) when compared with the control animals. Conversely, Monocytes count, Eosinophil count, Basophil count, Platelet count were relatively lowered in the treatment group when compared to the control but the decrease was not statistically difference ($p > 0.05$) as shown in Table I and II.

Table I: Shows the effects of Allium sativum on the Total white blood cell counts, Lymphocyte count, Neutrophil count, Red blood cell count, Packed cell volume

	Total White Blood Cell (x 10 ³ /μl)	Lymphocyte (x 10 ³ /μl)	Neutrophil (x 10 ³ /μl)	RBC Count (x 10 ³ /μl)	PCV%
CONTROL	5.83 ±0.18	63.65± 0.36	23.97±0.94	5.25± 0.19	44.83±2.48
GARLIC LOW DOSE	5.01 ± 0.20	68.8±1.14*	23.00± 0.64	4.74± 0.17	53.17± 0.48*
GARLIC HIGH DOSE	6.68 ±0.33*	59.10±1.36	30.13±0.40*	5.59±0.36*	53.67±0.56*

Values are mean ± S.E.M (n=6): * indicate significant difference when compared with the control (p<0.05)

Table II: Shows the effects of Allium sativum on the Monocytes count, Eosinophil count, Basophil count, Platelet count.

	Monocytes (x 10 ³ /μl)	Eosinophil (x 10 ³ /μl)	Basophil (x 10 ³ /μl)	Platelet (x 10 ³ /μl)
CONTROL	7.02±0.31	4.4 ±0.41	0.48± 0.05	445.8 ±21.15
GARLIC LOW DOSE	5.98± 0.43	3.4±0.63	0.49 ±0.06	369.5±7.66
GARLIC HIGH DOSE	6.12±0.38	3.37±0.37	1.90 ±0.56	405.7 ±46.06

Values are mean ± S.E.M (n=6)

Allium containing substances have antibiotic effects and antibiotics should enable the proliferation of circulating white blood cells considering that white blood cells function to protect the body from teratogens according to Augusti, 1996, this was confirmed by the significant increase in the Total white blood cell count in the animal treated with garlic juice extract as shown in Table I. The leukocytes, also called white blood cells, are the mobile units of the body's protective system. They are formed partially in the bone marrow (granulocytes and monocytes and a few lymphocytes) and partially in the lymph tissue (lymphocytes and plasma cells) and are found to increase in the treated animals but more significant in the animals treated with low dose of 1.0 g/kg body weight of Garlic juice extracts. Monocytes count was seen to be insignificantly lower in the treated animals when compared with the control animals this might have resulted from Anti-microbial effects, Antioxidant effects of garlic (Banerjee and Maulik. 2002). Microbial products can directly activate monocytes and this leads to production of pro-inflammatory and with some delay of anti-inflammatory cytokines. Typical cytokines produced by monocytes are TNF tumor necrosis factor, interleukin-1 and interleukin-12 (Swirski *et al*; 2009). Eosinophils are responsible for combating multicellular parasites and certain infections in vertebrates. Along with mast cells, they control mechanisms associated with allergy and asthma (Young *et al*; 2006). Eosinophils demonstrated insignificant decrease in the garlic treated animals when compared with the control animals. The decrease in the Eosinophils count in the treated animals demonstrate the antioxidant property of garlic juice extract as the free radical agent generate production of more Eosinophil, this is in agreement with (Rietz *et al*; 1995; Vazquez-Prieto *et al*; 2010). Basophils were also insignificant affected in the treated animals compared with the control animals. Recent studies in mice suggest that basophils may also regulate the behavior of T cells and mediate the magnitude of the secondary immune response (Nakanishi *et al*; 2010). Increase in the RBC count in the treated animals display the blood promoting action of the garlic juice extract as revealed by Griffiths, *et al*. 2002, stated that; Garlic is also a popular folk remedy, rich in flavonoids such as quercetin and sulfur compounds, such as allyl propyl disulphide that have perceived benefits to human health (Griffiths, *et al*. 2002). Consumption of garlic also has been reported to be associated with decreased platelet aggregation and bleeding events (Chagan *et al*; 2002). As a result, the literature has generally cautioned against using garlic while using anticoagulant therapy (Saw *et al*; 2006). Insignificant changes were noticed in the White blood pigment cells in the treated animals when compared with the control animals as shown in Table II. Increase in the RBC count in the treated animals display the blood promoting action of the garlic juice extract. Conversely,

Banerjee and Maulik, 2002 observed that *Allium* species have been implicated in the induction of haemolytic anaemia. They contain toxic components that may damage red blood cells and provoke haemolytic anaemia accompanied by Heinz bodies in erythrocytes of animals such as cattle, water buffalos, sheep, horses, dogs and cats (Banerjee and Maulik, 2002).

IV. CONCLUSIONS

Garlic juice extract has been found to possess antibiotic action by increasing the Total white cell count which may enhance immune system and also found to lead to a high response of production of antibodies. Thus garlic juice extracts demonstrated potential benefits to human health by causing increase in blood parameters implicated in promoting good health and maintaining blood factors required for body defence.

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