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Evaluation of the Effects of Garlic, Ginger and Turmeric on Selected Haematological Parameters in Wistar Rats

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Abstract

Garlic (*Allium sativum*), Ginger (*Zingiber officinale*) and Turmeric (*Curcuma longa*) have acquired a reputation in different traditions as prophylactic as well as therapeutic medicinal plants. The aim of the study was to unravel the effects of ethanol extracts of each of the spices on selected haematological parameters in Wistar Rats. Standard methods for analysis were used for this study. A total of 45 male Wistar rats were used in this study with 15 Wistar rats in three groups. Group I served as the control and the rest as test groups. The rats in Group II received 100 mg/kg BW and Group III received 200 mg/kg BW) of the sample extract for 21 days. Results obtained revealed that rats fed with ethanol extracts (100 mg/kg BW and 200 mg/kg BW) of garlic, ginger, and turmeric had a significantly ($p < 0.05$) increased PCV, Hb and WBC as well as a significant ($p < 0.05$) reduction in the platelet levels in the test groups when compared to the control respectively. The significant increase in PCV, Hb, and WBC levels confirmed the anti-anaemic and anti-infection properties of garlic, ginger, and turmeric, while the significant decrease in the platelet levels indicated their anti-coagulating potentials.

Keywords: Prophylactic, therapeutic, haematological, anti-anaemic, and anti-coagulant

Introduction

Dietary factors play a key role in the development of various human diseases. Across cultures, there are many different dietary patterns which are believed to promote human health. Despite cultural differences, there are

some shared characteristics of healthy dietary patterns. Perceiving plant foods as beneficial diet is advised by the folklore of many cultures over centuries (Bayan *et al.*, 2014).

Garlic (*Allium sativum*), ginger (*Zingiber officinale*), and turmeric (*Curcuma longa*) have been used for many years and have thus acquired a reputation in different traditions as prophylactic as well as therapeutic medicinal plants. They are used individually, or collectively as dietary and medicinal supplements and many researchers have confirmed their ability to maintain normal human health.

Pulverized garlic, ginger, and/or turmeric are popularly added to food as spices to improve the taste or for their medicinal benefits. They have been reported by the indigenes of Lokoja Metropolis of Kogi State of Nigeria that they help relieve nausea, abdominal pains, vomiting, and as well aid digestion. It is also believed by the locals that these medicinal plants help replenish blood loss.

Blood is a complex mixture of heterogeneous cell populations (Korytar *et al.*, 2013; Shen *et al.*, 2018; Fazio *et al.*, 2019) that include erythrocytes (red blood cells), leukocytes (white blood cells), and thrombocytes (analogs of mammalian platelets) (Lambert *et al.*, 2018). Haematological or blood analyses provide substantial information about the physiological aspects of animal welfare assessment, including the activation status of the neuroendocrine and immune system, acute and long-term impacts due to adverse husbandry conditions, potential diseases, and genetic predispositions (Seibel, 2021).

Materials and Methods

Procurement and Preparation of Sample Extracts

Fresh samples of garlic, ginger, and turmeric were bought from the Lokoja International Market, Lokoja, Kogi State, Nigeria. The method described by Trono *et al.* (2016) was adopted. Each sample was cleaned; air dried at room temperature for three (3) weeks and was pulverized using blender (Super Master Co., Ltd, Osaka, Japan). The resulting powdered product was stored in a sterilized container before the period of analysis. Ethanol was used as the solvent for extraction. The ethanol extract of each sample was prepared by soaking weighted powdered form of the sample in some quantity of ethanol. The combined extract was filtered through a vacuum filter using Whatman No. 1 filter paper. The resulting solution was subjected to heat using water bath heater at 55°C to obtain the extract.

Experimental Animals and Research Design

Fifteen (15) male Albino rats weighing between 150 to 200 g were used in the experiment for each of the samples. (A total of 45 rats were used in the experiment). The Albino rats were purchased from a Commercial Breeding Center, Ilorin, Kwara State, Nigeria. The animals were kept in standard wooden cage at the animal house under a strict compliance with the guide for animal research, as detailed in NIH (1985) Guidelines for the Care and Use of Laboratory Animals. The animals were fed ad libitum with commercially formulated pelletized rat feed (T.J. Top Feed Ltd, Port Harcourt, Nigeria) and water under a natural light/dark cycle. The animals were allowed to acclimatize in the standard wooden cage for 2 weeks before the commencement of the study to allow for adaptation of life in the cage.

After acclimatization period, the rats for each of the samples were allocated to three groups of five

rats each designated as Control Group (Group I) and Test Groups (Groups II, and III).

The weights of the rats were equalized as nearly as possible. The rats' treatments lasted for twenty-one (21) days. The treatments given to the rats are stated as follows:

Group I: Normal saline + feed + water.

Group II: 100 mg/kg BW of ethanol sample extract + feed + water.

Group III: 200 mg/kg BW of ethanol sample extract + feed + water.

Blood Sample Collection

At the end of administration period (21 days), rats from various groups were reweighed, anaesthetized with chloroform vapor, and dissected. Blood was collected by cardiac puncture into clean anticoagulant tubes for the selected haematological indices. The tubes were properly labeled and used for analysis.

Haematological Analysis

The White Blood Cell counts, Platelets and Hb were determined using standard methods described by Dacie and Lawis (1984). PCV was determined using Hawksley microcapillary tubes and centrifuge at 1,100 g for 5 minutes (Abudu and Sofola, 1994).

Statistical Analysis

Results were presented as mean and standard deviations of triplicate determinations. Group comparisons were done using the least significant difference (LSD). Significant difference was established at 5% level by one-way ANOVA followed by Duncan *post-hoc* test for multiple comparisons.

Results and Discussion

Results

Table 1: Effects of Garlic Extracts on Selected Haematological Parameters in Wistar Albino Rats

Group	Haematological Parameters			
	PCV	Hb	WBC (x 10 ⁹)	Platelets (x 10 ⁹)
Group 1	35.00 ± 2.00 ^a	11.53 ± 0.50 ^a	2.77 ± 0.25 ^a	4.03 ± 0.06 ^c
Group 2	47.33 ± 2.08 ^c	17.00 ± 1.00 ^c	5.13 ± 0.32 ^c	4.00 ± 0.10 ^c
Group 3	42.33 ± 2.08 ^b	13.43 ± 0.51 ^b	4.13 ± 0.15 ^b	2.97 ± 0.15 ^b

Data represented as mean ± S.D of concentrations of haematological parameters of PCV (%), Hb (g/dL), WBC (x 10⁹/l), and Platelets (x 10⁹/l). Data was analyzed by one- way ANOVA followed by Duncan *post-hoc* test for multiple comparisons, (n=3).

Mean values having different lowercase letters as superscripts are considered significant (p < 0.05) down the column. PCV: Packed Cell Volume; Hb: Haemoglobin; and WBC: White Blood Cells

Table 2: Effects of Ginger Extracts on Selected Haematological Parameters in Wistar Albino Rats

Group	Haematological Parameters			
	PCV	Hb	WBC (x 10 ⁹)	Platelets (x 10 ⁹)
Group 1	35.00 ± 2.00 ^b	11.53 ± 0.50 ^b	2.77 ± 0.25 ^a	4.03 ± 0.06 ^b
Group 2	43.67 ± 1.15 ^c	14.33 ± 0.35 ^c	3.47 ± 0.25 ^b	3.00 ± 0.20 ^a
Group 3	52.00 ± 2.65 ^d	16.67 ± 0.31 ^d	4.13 ± 0.15 ^c	3.03 ± 0.06 ^a

Data represented as mean ± S.D of concentrations of haematological parameters of PCV (%), Hb (g/dL), WBC (x 10⁹/l), and Platelets (x 10⁹/l). Data was analyzed by one- way ANOVA followed by Duncan *post-hoc* test for multiple comparisons, (n=3).

Mean values having different lowercase letters as superscripts are considered significant (p < 0.05) down the column. PCV: Packed Cell Volume; Hb: Haemoglobin; and WBC: White Blood Cells.

Table 3: Effects of Turmeric Extracts on Selected Haematological Parameters in Wistar Albino Rats

Group	Haematological Parameters			
	PCV	Hb	WBC (x 10 ⁹)	Platelets (x 10 ⁹)
Group 1	35.00 ± 2.00 ^{ab}	11.27 ± 0.31 ^a	2.77 ± 0.25 ^a	4.03 ± 0.06 ^c
Group 2	37.00 ± 1.00 ^b	12.16 ± 0.29 ^b	4.60 ± 0.20 ^d	3.00 ± 0.20 ^a
Group 3	46.33 ± 1.15 ^c	15.09 ± 0.18 ^c	6.00 ± 0.10 ^e	3.37 ± 0.12 ^b

Data represented as mean ± S.D of concentration of haematological parameters of PCV (%), Hb (g/dL), WBC (x 10⁹/l), and Platelets (x 10⁹/l). Data was analyzed by one- way ANOVA followed by Duncan *post-hoc* test for multiple comparisons, (n=3).

Mean values having different lowercase letters as superscripts are considered significant (p < 0.05) down the column. PCV: Packed Cell Volume; Hb: Haemoglobin; and WBC: White Blood Cells

Discussion

Assessment of haematology is of diagnostic importance in the routine clinical evaluation of the state of health of animals (Hoff-Brand and Pettit, 2000). Haematology is also used to explain the blood relating functions of consumed substances (Duru *et al.*, 2012). Yakubu *et al.* (2007) noted that assessment of haematological parameters cannot only be used to determine the extent of deleterious effect of extracts on the blood of an animal, but it can also be used to explain blood relating functions of a plant extract or its products. The observed significant increase (p < 0.05) in the PCV (Tables 1, 2, and 3) in the test groups against the controls of the extract studied (garlic, ginger, and turmeric) indicates potential anti-anaemic effects with increase in erythrocytosis in the experimental animals. The same trend was observed for haemoglobin (Hb), which is an iron-containing component of RBC, in all the test groups against the controls.

It was further observed as shown in Tables 1, 2, and 3 that the extract was associated with a significant (p < 0.05) increase in the WBC in the test groups when compared to the control groups.

These observations are in line with the works of Oluwole (2001), Iranloye (2002), and Olaniyan *et al.* (2013). The significant increase in PCV, Hb, and WBC observed in the present study could be evidence of erythropoiesis and leucopoiesis caused by administration of the samples.

The present study further showed a significant (p < 0.05) decrease in the blood platelets in the test groups when compared to the control groups in the three samples studied. This decrease shows the anti-platelet potentials of the extract. This finding corresponds to an earlier study by Olaniyan *et al.* (2013) which also showed a significant (p > 0.05) decrease in the blood platelets of adult wistar rats administered with garlic. Consumption of garlic had earlier been reported to be associated with decreased platelet aggregation and bleeding events (2002). The finding in present study agrees with previous report of Duttaroy (2018) which showed that the three plants in addition to feverfew, ginseng, and willow bark have anti-platelet factors. This observed anti-platelet properties cannot be unrelated to the ability of the samples to inhibit cyclooxygenase activity and thus thromboxane A₂ formation, by suppressing mobilization of intraplatelet Ca²⁺, and by

increasing levels of cAMP and cGMP. They can also interact directly with the GPIIb/IIIa receptors, thus reducing the ability of platelets to bind to fibrinogen and this inhibition of platelet aggregation occurred by multiple mechanisms and may have a role in preventing cardiovascular disease (Rahman, 2007).

Conclusion

The present study has revealed that daily administration of either garlic, ginger, or turmeric significantly increases Packed Cell Volume (PCV), Haemoglobin (Hb), and White Blood Cells (WBC) but significantly decreases the Blood Platelets in Wistar Albino Rats. These observations are in line with some previous studies. It may be beneficial to include the consumption of these plants as part of the Recommended Daily Intake.

Conflicts of Interest

There were no conflicts of interest declared by the authors.

Ethical Standard of Research Involving Animals

All institutional and national guidelines for the care and use of laboratory animals were followed.

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