COMPARATIVE EFFECTS OF GARCINIA KOLA AND GARLIC EXTRACTS ON THE SOME LIVER AND HEAMATOLOGICAL FUNCTIONS OF HIGH SALT DIET INDUCED HYPERTENSIVE WISTAR ALBINO RATS.

Abstract

*Garcinia kola*is commonly consumed in Nigeria in social ceremonies, while *G*arlic is commonly used as a spice in preparation of certain foods. In this study, the protective effects of extracts of the plants against high salt diet (8% NaCl) induced hypertension were investigated in rats. Extracts prepared from the plants were subjected to phytochemical screening and acute and sub-acute toxicity studies in rats. In the protective study against salt induced hypertension. 35 adult male rats divided into 7 groups of 5 rats were assigned treatment with group 1 serving as the normal control and group 2, the disease control group treated with only the high salt diet. Groups 3 and 4 were administered 500 mg/kg body weight of Garcinia kola and garlic extracts respectively alongside the induction diet. Also group 5 and 6 were administered 1000mg/kgbody weight of Garcinia kola and garlic extracts respectively alongside the induction diet, while group 7 received a combination of the two extracts alongside induction. Treatment commenced after confirmation of hypertension and lasted for 2 weeks before animals were sacrificed to collect blood for liver and hematological analysis. Results obtained showed that G.kola and Garlic feeding produced in rats following liver and hematological assays as values of these parameters in the test groups did not significantly differ from control values ($p<0.05$).

Keywords: Garcinia kola, Garlic, Liver Function Markers, Hematological Parameters and Albino rats.

1.0 Introduction

Bitter kola (Garcinia kola Hackel) belongs to the genus Garcinia (Family: Guttiferae), is an indigenous medicinal tree that is often referred to as ‘wonder plant’ because all its parts have

medicinal properties (Manourova et al. 2017). Garcinia kola is well branched, evergreen polygamous trees and is found in moist forests throughout West and Central Africa (Anegbeh et al.2006). This fruit tree has a regular fruiting cycle and produces fruits every year making it one of the most important trees valued in Nigeria (Anegbeh et al. 2006), West and Central Africa. The seeds, leaves and bark of G. kola are highly medicinal with high pharmacological uses (Ashirue et al. 2018). The seeds have been reportedly used for the treatment of coughs, throat infections, bronchitis, hepatitis (inflammation of the liver), and liver disorders (Farombi et al. 2005 &Anegbeh et al. 2006). G.kola seeds have also been found to exhibit inhibitory effects on lipid peroxidation in rat liver homogenate (Manourova et al.2017). Antwi-Boasiako and Abubakari (2011) states that the seed's bitter stimulants are also used as snake repellent when they are placed around the compound. Other medicinal uses include: purgative, antiparasitic, antimicrobial. The seeds are used to prevent and relieve colic, cure head or chest colds (Ashieru et al. 2018). The seeds constituents include biflavonoids, xanthones and benzophenones and other anti-oxidant and protective properties which could be widely exploited (Antwi-Boasiako& Abubakari, 2011). The antimicrobial properties of this plant are attributed to the benzophenones, flavanones. According to Orie and Ekon, (1993) as cited by Anegbeh et al. (2006), this plant has shown bronchodilator effect, anti-inflammatory, antimicrobial, antibacterial and antiviral properties.

Garlic is a bulbous herbs used as food item, spice and medicine in different parts of the world (Salami et al., 2012). Allium sativa (garlic) is widely used as flavouring vegetables for its aroma and taste in various types of food worldwide (Salami et al., 2012). Garlic is widely recognized as a functional foodstuff that possesses a variety of beneficial effects on human health. (Tattelman, 2005). Since garlic especially possesses advantageous roles in blood circulation among its physiological effects on the human body, the prevention of cardiovascular disease and other metabolic syndromes by garlic has been well documented.(Rahman & Lowe, 2006 and Banerdee et al., 2002). Several studies have indicated that garlic and its preparation increased fibrinolytic activity (Andrianova et al., 2001) but inhibited platelet aggregation(Rahman, & Billington, 2000 and Allison et al., 2006) as well as lowering blood pressure(Qidwal et al., 2000 and Dhawan et al., 2004) and levels of cholesterol(Durak et al., 2004 and Thompson et al., 2006) in humans. These effects are advantageous in preventing or ameliorating cardiovascular disorders such as acute myocardial infarction caused by occlusion of blood circulation due to damage to or dysfunction of vascular endothelial cells (VECs), resulting in the formation of blood clot called thrombus (Hideharu et al., 2007).

The present study was therefore undertaken to investigate the comparative effects of G. kola seed and Garlicon some haematological and liver function indices of wistar albino rats.

2.0. Materials and Methods

2.1. Plant Materials: Fresh bulbs of *Garlic* and fruits of *Garcinia kola* were obtained from a local vegetable market in Umuahia North Local Government Area, Abia State and were authenticated at the Department of Forestry, College of Natural Resources and Environmental Management, Michael Okpara University of Agriculture, Umudike by Mr. Azuka.

2.2. Animal Materials: thirty five male albino rats of the wistar strain (130-180g)were obtained from the Animal House of the Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike, housed in Aluminum cages and allowed to acclimatize for two weeks to allow for proper adaptation to their new environment and living conditions before commencement of the study. The experimental rats were fed at liberty with vital finisher's mash (Vital feed, Nigeria) and clean water but starved for 12 hours prior to the commencement of experiment. All animal experiments were conducted in compliance international guidelines for care and use of laboratory animals (Oriek*eet al*., 2019). The study was conducted in the Department of Biochemistry, Michael Okpara University of Agriculture, Umudike.

2.3. Study Design

The animals used were divided into seven groups, each group consisting of five rats. Group I served as control and received normal feed and distilled water for 14 days. Group II rats received high salt diet for 14 days. Group III rats received high salt diet with 500mg/kg of Garlic extracts for 14 days. GroupIV rats received high salt diet with 500mg/kg of G.kola extracts for 14 days. Group V rats received high salt diet with 1000mg/kg of Garlic extracts for 14 days. Group VI received high salt diet with 1000mg/kg of G.kola extracts for 14 days. While group VII received high salt diet with 500mg/kg of each Garlic and G.kola extracts for 14 days

All the animals in groups I to VII were allowed access to water and rat diet ad libitum throughout the duration of the experiment. At the end of the experimental period, the animals were fasted for 12 hours and then sacrificed under chloroform anaesthesia.Blood samples were collected and transferred into:

i. Labelled tubes containing ethylene diamine tetra-acetic acid (EDTA) anticoagulant for determination of haemoglobin concentration, percentage packed cell volume, and red and white blood

cell count based on the methods described by Dacie and Lewis (1991), modified by Chabra, (2018) and Bain *et al., (*2012).

ii. Labelled tubes without anticoagulant, and allowed to clot. Serum was obtained by centrifuging at 3,000 rpm for 10minutes in a wisperfuge centrifuge (model 1384). The serum thus obtained was used for determination of total cholesterol concentration (using assay kit from Randox Laboratories, UK), total bilirubin concentration (using the method described by Tietz, 1986 and WHO, 2010) and for the assay of the activities of alkaline phosphatase (using assay kit from Randox Laboratories, UK) and alanine (ALT) and aspartate (AST) aminotransferases (Using an assay kits from Randox Laboratories, UK).

3.0. Statistical analysis

All values were expressed as mean±standard error of mean (SEM). Statistical comparisons between group means were performed using analysis of variance (ANOVA), followed by student t'test. The group means were considered to be significantly different at $p<0.05$.

4.0. Results

Table 1: EFFECT OF TOTAL PROTEIN ON LIVER FUNCTION PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	7.17 ± 0.39^{a}	7.40 ± 0.45^{b}	7.11 ± 0.14^{c}
2	Induction only	7.52 ± 0.35^{a}	5.99 ± 0.19^{a}	6.01 ± 0.10^{a}
3	Induction + garlic extract 500mg/kg	6.64 ± 0.38^{a}	6.32 ± 0.40^{a}	6.76 ± 0.17^{b}
4	Induction + G. kola extract 500mg/kg	6.58 ± 0.35^{a}	6.06 ± 0.25^{a}	6.82 ± 0.08^{b}
5	Induction + garlic extract 1000mg/kg	6.86 ± 0.58^{a}	6.34 ± 0.42^{a}	6.98 ± 0.19^{b}
6	Induction + G. kola extract 1000mg/kg	6.60 ± 0.57^{a}	6.08 ± 0.47^{a}	6.84 ± 0.10^{b}
7	Induction + Garlic 500 + G.kola 500	6.84 ± 0.72^{a}	6.11 ± 0.57^{a}	6.93 ± 0.13^{bc}

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p< 0.05$).

Table 2: EFFECT OF ALBUMIN ON LIVER FUNCTION PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	3.87±0.34[a]	4.36±0.06[b]	3.99±0.15[c]
2	Induction only	3.89±0.37[a]	3.46±0.31[a]	3.05±0.05[a]
3	Induction + garlic extract 500mg/kg	3.34±0.33[a]	3.37±0.27[a]	3.63±0.07[b]
4	Induction + G. kola extract 500mg/kg	3.99±0.15[a]	3.39±0.27[a]	3.58±0.09[b]
5	Induction + garlic extract 1000mg/kg	3.56±0.35[a]	3.59±0.29[a]	3.85±0.09[b]
6	Induction + G. kola extract 1000mg/kg	3.40±0.37[a]	3.40±0.29[a]	3.60±0.10[b]
7	Induction + Garlic 500 + G.kola 500	3.97±0.15[a]	4.34±0.06[b]	3.92±0.10[c]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 3: EFFECT OF ALT (U/L)ON LIVER FUNCTION PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	28.33±1.53[a]	14.33±3.22[a]	30.33±1.53[a]
2	Induction only	30.33±1.53[a]	51.33±6.11[b]	62.00±7.55[c]
3	Induction + garlic extract 500mg/kg	38.00±2.00[b]	56.33±4.73[b]	47.33±2.31[b]
4	Induction + G. kola extract 500mg/kg	42.33±3.22[b]	56.00±2.65[b]	44.33±3.22[b]
5	Induction + garlic extract 1000mg/kg	40.00±3.00[b]	58.35±4.75[b]	49.35±2.33[b]
6	Induction + G. kola extract 1000mg/kg	43.35±3.24[b]	58.00±4.87[b]	46.35±3.24[b]
7	Induction + Garlic 500 + G.kola 500	30.33±1.53[a]	58.00±2.65[b]	44.33±2.52[b]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 4: EFFECT OF AST ON LIVER FUNCTION PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	18.33 ± 2.52^{a}	18.00 ± 5.00^{a}	20.33 ± 2.52^{a}
2	Induction only	75.00 ± 6.56^{d}	81.00 ± 7.00^{b}	77.00 ± 6.56^{d}
3	Induction + garlic extract 500mg/kg	48.33 ± 1.53^{bc}	74.67 ± 6.03^{b}	50.33 ± 1.53^{bc}
4	Induction + G. kola extract 500mg/kg	45.67 ± 2.52^{b}	82.00 ± 2.00^{b}	47.67 ± 2.51^{b}
5	Induction + garlic extract 1000mg/kg	48.55 ± 2.55^{bc}	76.69 ± 6.05^{b}	50.35 ± 2.55^{bc}
6	Induction + G. kola extract 1000mg/kg	47.69 ± 2.544^{b}	84.00 ± 2.00^{b}	49.89 ± 2.53^{b}
7	Induction + Garlic 500 + G.kola 500	43.33 ± 1.16^{b}	84.00 ± 2.00^{b}	45.33 ± 1.16^{b}

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 5: EFFECT OF ALP ON LIVER FUNCTION PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	76.33 ± 3.51^{a}	76.67 ± 4.16^{a}	79.00 ± 3.61^{a}
2	Induction only	134.33 ± 4.73^{d}	128.67 ± 9.45^{b}	136.33 ± 4.73^{d}
3	Induction + garlic extract 500mg/kg	109.33 ± 7.77^{c}	119.67 ± 10.50^{b}	111.33 ± 7.77^{c}
4	Induction + G. kola extract 500mg/kg	106.33 ± 4.51^{bc}	138.67 ± 13.65^{b}	108.33 ± 4.51^{bc}
5	Induction + garlic extract 1000mg/kg	109.35 ± 7.79^{c}	139.69 ± 10.52^{b}	113.35 ± 7.79^{c}
6	Induction + G. kola extract 1000mg/kg	108.35 ± 4.53^{bc}	138.69 ± 13.67^{b}	108.35 ± 4.53^{bc}

7	Induction + Garlic 500 + G.kola 500	97.00±4.58[b]	140.67±13.65[b]	99.00±4.58[b]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 6: EFFECT OF TOTAL BILIRUBIN ON LIVER FUNCTION PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	0.48±0.08[a]	0.50±0.2[a]	0.51±0.04[a]
2	Induction only	0.64±0.13[ab]	1.63±0.12[b]	1.40±0.08[c]
3	Induction + garlic extract 500mg/kg	0.80±0.05[b]	1.52±0.08[b]	0.77±0.04[b]
4	Induction + G. kola extract 500mg/kg	0.72±0.05[b]	1.46±0.07[b]	0.74±0.05[b]
5	Induction + garlic extract 1000mg/kg	0.82±0.07[b]	1.54±0.08[b]	0.79±0.06[b]
6	Induction + G. kola extract 1000mg/kg	0.73±0.07[b]	1.68±0.09[b]	0.76±0.07[b]
7	Induction + Garlic 500 + G.kola 500	0.73±0.06[b]	1.52±0.08[b]	0.75±0.03[b]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

From the results above, the functionality of the liver was confirmed by assessing the plasma levels of alanine (ALT), aspartate (AST), ALP, total protein, albumin and total bilirubin levels. The markers of hepatic values as depicted in Tables above shows a significant ($p<005$) difference in the ALT,AST,ALP, total protein, albumin and total bilirubin levels were observed in the plasma of high salt induced hypertensive rats when compared with the control rats. Oral treatment of High salt induced hypertensive rats with G.kola and garlic extracts significantly restored the levels of these biomarkers to near normalcy. Administration of G.kola and garlic alone did not affect the liver and kidney function parameters during this study.

Table 7: EFFECT OF RBC ($x10^3/mm^3$)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	4.86±0.18[c]	5.07±0.24[b]	6.94±0.12[d]
2	Induction only	3.68±0.17[a]	3.94±0.13[a]	5.70±0.10[a]
3	Induction + garlic extract 500mg/kg	4.38±0.10[b]	4.03±0.17[a]	6.40±0.10[c]
4	Induction + G. kola extract 500mg/kg	4.48±0.18[b]	3.86±0.12[a]	6.50±0.18[c]
5	Induction + garlic extract 1000mg/kg	4.40±0.12[b]	4.25±0.19[a]	6.62±0.12[c]
6	Induction + G. kola extract 1000mg/kg	4.50±0.20[b]	3.88±0.14[a]	6.62±0.18[c]
7	Induction + Garlic 500 + G.kola 500	4.59±0.90[b]	5.96±0.12[c]	6.61±0.09[c]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 8: EFFECT OF HB (g/dl)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	13.27±0.31[a]	14.37±1.48[a]	15.37±0.40[c]
2	Induction only	11.93±0.93[a]	13.80±0.29[a]	13.47±0.25[a]
3	Induction + garlic extract 500mg/kg	14.07±0.12[b]	13.33±1.15[a]	14.27±0.12[b]
4	Induction + G. kola extract 500mg/kg	14.20±0.36[b]	13.43±0.37[a]	14.37±0.40[b]
5	Induction + garlic extract 1000mg/kg	14.09±0.15[b]	13.35±1.17[a]	14.29±0.14[b]
6	Induction + G. kola extract 1000mg/kg	14.22±0.38[b]	13.45±0.39[a]	14.39±0.42[b]
7	Induction + Garlic 500 + G.kola 500	14.30±0.36[b]	15.50±0.62[a]	14.50±0.36[b]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 9: EFFECT OF PCV (%)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	13.967±0.51[a]	44.00±1.00[b]	15.10±0.52[a]
2	Induction only	38.50±1.15[b]	37.00±1.00[a]	39.60±1.15[b]
3	Induction + garlic extract 500mg/kg	41.93±0.50[d]	37.67±1.52[a]	43.00±0.50 [d]
4	Induction + G. kola extract 500mg/kg	42.30±0.30[d]	36.00±1.00[a]	43.40±0.30 [d]
5	Induction + garlic extract 1000mg/kg	42.95±0.52[d]	37.69±1.53[a]	43.02±0.52 [d]
6	Induction + G. kola extract 1000mg/kg	42.32±0.52[d]	36.02±1.22[a]	43.42±0.32 [d]
7	Induction + Garlic 500 + G.kola 500	42.60±0.46[d]	38.00±1.00[a]	43.67±0.42[d]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 10: EFFECT OF WBC ($x10^3/mm^3$)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	8.07±0.37[a]	7.90±0.26[a]	8.82±0.12[a]
2	Induction only	8.39±0.23[a]	9.70±0.36[c]	9.43±0.27[b]
3	Induction + garlic extract 500mg/kg	7.85±0.16[a]	8.33±0.15[ab]	8.89±0.21[a]
4	Induction + G. kola extract 500mg/kg	7.91±0.17[a]	8.90±0.44[b]	8.98±0.21[a]
5	Induction + garlic extract 1000mg/kg	7.87±0.18[a]	8.35±0.17[ab]	8.89±0.23[a]
6	Induction + G. kola extract 1000mg/kg	7.93±0.19[a]	8.92±0.46[b]	8.98±0.23[a]
7	Induction + Garlic 500 + G.kola 500	7.95±0.20[a]	9.00±0.26[b]	8.99±0.21[a]

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 11: EFFECT OF PLT ($x10^3/mm^3$)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	212.33±10.69^{ab}	158.00±15.72^{a}	220.00±14.73^{ab}
2	Induction only	234.33±4.73^{c}	177.67±14.97^{a}	244.33±4.73^{c}
3	Induction + garlic extract 500mg/kg	203.00±2.00^{a}	188.00±2.00^{a}	215.67±3.05^{ab}
4	Induction + G. kola extract 500mg/kg	210.67±5.03^{ab}	188.67±2.08^{a}	215.67±5.86^{ab}
5	Induction + garlic extract 1000mg/kg	205.02±2.02^{a}	188.22±2.02^{a}	215.69±3.07^{ab}
6	Induction + G. kola extract 1000mg/kg	211.69±5.05^{ab}	188.69±2.08^{a}	217.69±5.88^{ab}
7	Induction + Garlic 500 + G.kola 500	205.33±4.51^{a}	181.00±18.24^{a}	207.33±4.5^{a}

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 12: EFFECT OF MCV (pg)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	23.18±0.95^{a}	29.22±4.42^{a}	21.74±0.51^{a}
2	Induction only	27.33±1.66^{a}	52.86±22.69^{b}	69.47±0.61^{d}
3	Induction + garlic extract 500mg/kg	22.66±2.52^{a}	56.54±2.29^{b}	67.19±0.83^{bc}
4	Induction + G. kola extract 500mg/kg	44.62±16.50^{b}	61.10±6.87^{b}	66.76±1.68^{bc}
5	Induction + garlic extract 1000mg/kg	24.68±2.54^{a}	58.56±2.49^{b}	69.19±0.85^{bc}
6	Induction + G. kola extract 1000mg/kg	46.63±18.52^{b}	62.12±6.89^{b}	68.78±1.88^{bc}
7	Induction + Garlic 500 + G.kola 500	60.66±0.50^{c}	66.93±1.32^{b}	66.03±0.41^{b}

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 13: EFFECT OF MCH (fl)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	23.18±0.95^{ab}	21.86±0.31^{a}	22.12±0.21^{a}
2	Induction only	27.33±1.66^{bc}	23.45±0.68^{a}	23.63±0.35^{b}
3	Induction + garlic extract 500mg/kg	22.66±2.51^{ab}	23.33±0.76^{a}	22.27±0.27^{a}
4	Induction + G. kola extract 500mg/kg	22.50±3.02^{ab}	23.18±1.07^{a}	21.72±0.10^{a}
5	Induction + garlic extract 1000mg/kg	22.68±2.53^{ab}	23.35±0.78^{a}	22.29±0.29^{a}
6	Induction + G. kola extract 1000mg/kg	22.52±3.24^{ab}	23.38±1.29^{a}	21.74±0.12^{a}
7	Induction + Garlic 500 + G.kola 500	20.83±0.53^{a}	21.86±0.31^{a}	22.50±0.57^{a}

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

Table 14: EFFECT OF MCHC (g/dl)ON HEAMATOLOGY PARAMETERS

GROUP	TREATMENT	PRE-INDUCTION	POST-INDUCTION	POST-TREATMENT
1	Normal Control	57.00±9.53^{b}	64.82±0.83^{a}	101.76±1.70^{b}
2	Induction only	31.66±0.95^{a}	65.46±1.11^{a}	34.01±0.38^{a}
3	Induction + garlic extract 500mg/kg	31.16±0.63^{a}	65.12±1.13^{a}	33.18±0.64^{a}
4	Induction + G. kola extract 500mg/kg	31.08±0.70^{a}	65.26±1.24^{a}	33.10±0.70^{a}
5	Induction + garlic extract 1000mg/kg	31.38±0.65^{a}	65.14±1.15^{a}	33.20±0.86^{a}
6	Induction + G. kola extract 1000mg/kg	31.20±0.72^{a}	65.28±1.26^{a}	33.32±0.72^{a}
7	Induction + Garlic 500 + G.kola 500	30.85±0.01^{a}	64.90±0.81^{a}	33.20±0.57^{a}

Values are means ± standard deviation.

Values with different superscripts down the column differ significantly ($p < 0.05$).

4.1. Discussion

Hypertension is a reliable indicator of premature death (ingale et al., 2014). It is a risk factor for stroke, coronary heart disease and renalvascular diseases (Airaodion et al., 2019). The control of blood pressure through diet has been the focal point of public health and mass media attention. The method in practice to control high blood pressure is "long-term" drug therapy. Drugs have side effects that can create more clinical problems than are solved (Airaodion et al., 2019). That is why medical professionals worldwide are seeking non-drug treatment and preventative strategies.

Garcinia kola contains dimeric flavonoids (Eleyinmi et al, 2006), which is believed to have many healing benefits. The biological activities of flavonoids include action against allergies, inflammation, free radicals, hepatoxins (Terashima et al., 2002).

Garlic contains several bioactive compounds, including allicin, which has antioxidant activity (Prasad et al., 1995). Some studies showed that allicin could lower BP (Ali et al., 2000) & (Dubey et al., 2017). Therefore, garlic supplements may ameliorate hypertension by its antioxidant effect. Garlic might also elicit its antihypertensive effects by inhibition of angiotensin-converting enzymes (ACEs). Sharifiet al.2007 reported that garlic and allicin could decrease ACE activity in a hypertensive rat model.

The significant increase observed in the serum of animals fed with salt feed diet without treatment with garlic and Garcinia juice showed that salt causes hypertension. This is in agreement with the report of Alamgeer et al., 2013, who reported the antihypertensive activity of aqueous methanol extract of Berberis Orthobotrys Bien Ex Aitch in rats. Salts have been reported to contain high sodium concentration (Grassi et al., 2002) and (Cook N.R. 2014). Excessive sodium consumption (defined by the World Health Organization as >5 g sodium per day World health Organisation 2012) has been shown to produce a significant increase in BP and has been linked with onset of hypertension and its cardiovascular complications (Weinberger, 1996 & Strazzullo et al., 2009) This might be responsible for the sustained increase in blood pressure of animals fed with high salt diet without treatment with garlic and Garcinia kola juice. This is also consistent with the reports of Airaodion et al, 2019 and Spence et al. 2012.

This study examined the effects of Garcinia kola and garlic on high salt induced hypertensive rats. In this study, rats fed G. kola seed was found to exhibit non-significant differences ($p>0.05$) in serum total bilirubin concentration and activities of AST, ALT, and ALP as compared with control.

In our study, no significant changes were observed in other hematological parameters. As a result, the extract has a minimal erythropoietic effect but causes moderate leucopenia with lymphocytosis and a decrease in all other WBC lines. The extract significantly decreased the volume of the cell mean cell and hemoglobin cell means in the serum of the animals ($p < 0.05$). However there are controversial reports about the effects of *Garcinia Kola and Garlic* on RBC count, Hb, MCV and MCH as positive haematological effects through increasing RBC or induction of macrocytic normochromic anaemia or haemolyticanaemia in some animal species (Abdel Gadir,2006; Olaniyan,2013; Banerjee & Maulik, 2002) . The ethanolic extract of *G kola* and garlic has hematological, stimulating, and enhancing effects due to its antioxidant qualities (Atsukwei et al., 2015). These findings suggest that it has no harmful effects on the liver's function and may have a beneficial effect, as indicated by its capacity todrastically lower total serum cholesterol and increase WBC count (Tamuno-Emine et al., 2015).

5.0. Conclusion

The results of this study indicated that high salt diet causes significant hypertension; these findings were reversed by ethanolic G.kola and garlic extract administration. Taken together, the findings from the present investigation demonstrated that administration of G. kola and Garlic extracts significantly ameliorated hypertention-mediated Liver and Heamatological functions in high salt-induced hypertensive rats. From this study, it can, thus, be suggested that extract of *Garcinia kola* and Garlic, possesses antihypertensive effect possibly due to its antioxidant.

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