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# ANTIDYSLIPIDEMIC EFFECT OF ETHANOL EXTRACT OF *IRVINGIA WOMBOLU* SEEDS IN HIGH FAT DIET INDUCED DYSLIPIDEMIC RAT

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## ABSTRACT

*The antidyslipidemic activity of Irvingia wombolu ethanol seeds extract was studied in high fat diet induced dyslipidemic rats.Forty five (45) Wstar rats were grouped into 5 groups of 9 rats each. The animals were allowed 7 days acclimatization period. Group 1 was the control group and it received normal rat chow and water throughout the study. Groups 2 to 5 were given high fat diet for 14 days after which they were given normal rat chow till the end of the study. At the end of the 14 days, group 2 was not treated while group 3-5 were treated with 250, 500 and 1000mg/kg b.w ethanol extract of Irvingiawomboluseeds respectively for 28 days. The lipid profile of animals was evaluatedthree times: first after 14 days induction period (phase 1) i.e day 0 of treatment, second was taken 14 days after treatment (phase 2), third was taken 28 days after treatment (phase 3).The study lasted for 49 days and dimethylsulphoxidewas used as a vehicle for the extract. In phase 1, all the groups fed with high fat diet showed an increase in low density lipoprotein (LDL) triglyceride, total cholesterol and a decrease in high density lipoprotein (HDL) levels. In phase 2 there was a decrease in LDL, triglyceride and total cholesterol level in addition to increase in HDL for animals in all the treatment groups. It was observed that in phase 3 only 250mg/kg group showed a progressive decrease inLDL, triglyceride, total cholesterol and an increase in HDL levels while 500 and 1000 mg/kg b.w showed an increase in LDL, triglyceride and total cholesterol level and a decrease in HDL. The result of the present study demonstrated the antidyslipidemiceffectof ethanol extract of Irvingia wombolu seeds at lower dose.*

## INTRODUCTION

Dyslipidemia is a chronic, metabolic disease characterized by increased total cholesterol (TC), low-density lipoprotein cholesterol (LDLC), and triglyceride (TG) levels or decreased high-density lipoprotein cholesterol (HDL-C) and thus, a risk factor for cardiovascular diseases (Okafor et al., 2015; Kopin and Lowenstein, 2017; Ji et al., 2019). The increase in serum LDL-cholesterol level appears to be an important factor for atherogenesis LDL consists of more than 75% of the atherogenic lipoproteins, infiltration of LDL into the arterial wall initiates and promotes atherosclerosis (Aumeeruddy and Mahomoodally 2022).FDA approved drugs for management of dyslipidemia are expensive, example includes, HMG-CoA reductase inhibitors (also called statins), bile

acid sequestrants, fibrates, niacin, cholesterol absorption inhibitors, omega-3 fatty acid, and combination medicines (FDA 2015; Devi and singh 2017). However, the side effects and discomforts associated with these medications, such as constipation, dizziness, diarrhea, headache, and upset stomach amongst others, have urged the scientific community to search for safer and more effective medications to maintain healthy populations (Food and Drug Administration, 2015). Researcher interest has been focused on various herbs that possess antidyslipidemic effect that may be helpful in reducing the risks of cardiovascular diseases (Devi and singh 2017). According to the International LipidExpert Panel (ILEP), nutraceutical therapies containing herbal monomers and derivatives seem to be very safe and well tolerated (Cicero et al., 2017) and has recommended the use of such nutraceuticals as a lipid-lowering alternative to statins in intolerant populations (Banach et al., 2018;Ji et al., 2019)

*Irvingia ceaegabonensis* and *Irvingiaceae wombolu* kernels are well known in the *Irvingiaceae (Acanthaceae)* family of plants. However, *I. gabonensis* is known for its edible fleshy fruits by which it has other common names like dika fruit, African bush mango, wild mango, sweet bush mango; whereas the fruit of *I. wombolu* is bitter and not eaten but their kernels are used in local food preparations (Leakey et al., 2005; Ainge and Brown, 2001; Okolo, 2000).

Itis endemic to the north Angola, Congo, Nigeria, Ghana, Togo, Benin, Côte d'Ivoire and south-west Uganda. In Nigeria, Ghana and Gabon, the powdered full fat kernels of either, *I. gabonensis* or *I. wombolu* or a mixture of both is cooked with leafy vegetables (Eka, 1980; Ekpe et al., 2007), chili powder, smoked fish, crayfish, meat, spices and other additives into a thick, gelatinized, slimy and assorted draw soup called ogbono soup. Is usually eaten as a delicacy with solid foods such as foofo or ebain the some part of Nigeria, and based on its nutritional properties, the kernel oil and meal have been reported as potential base materials for confectioneries, edible fats, soaps and cosmetics(Agbor, 1994; Joseph, 1995 and Ayuk et al ., 1999; Akajiaku et al., 2024).

Previous work on the seeds has centered on the nutritional potentials of the plant, there is no detailed report on the use the seed in the management of dyslipidemia.

In the present study we investigated the effect of ethanol extract of *I.wombolu* seeds on lipid profile and atherogenic indices in order to identify its therapeutic benefits in a hypercholesterolemic **rat model**.

## MATERIAL AND METHODS

### Collection and preparation of plant materials

The fruit of *I. wombolu* were collected from Sagbama village in Bayelsa state, Nigeria. The pulp was removed to expose the nut which was cracked to obtain the seeds. The seeds were washed and dried in a laboratory drier set at 50ºC after which it was ground with a manual grinder. One thousand grams of ground seeds were extracted with adequate quantity of ethanol and extract was allowed to evaporate to form sludge.

### Experimental design

Forty five (45) Wstar rats purchased from Department of Veterinary Medicine, University of Nigeria Nsukka, Enugu State and kept in the Department of Biochemistry, University of Port-Harcourt animal house. The animals were grouped into 5groups of 9rats, one control group and 4test groups. They were allowed 7days acclimatizon period. The study was done in 3phases. Phase

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1is the induction stage were the animals in the test groups were given high fat diet for 14 days. Phase 2 is 14 days treatment stage, the animals were given normal rat chow with different doses of the extract and phase 3 is 28 days treatment stage, the animals were given normal rat chow with different doses of the extract. Three animals were killed from each group at the end of each phase. Lipid profile of animals was assayed three times: first after 14 days induction period (phase 1) i.e day 0 of treatment, second was taken 14 days after treatment (phase 2), third was taken 28 days after treatment (phase 3). Dimethylsulphoxide (DMSO) was used as vehicle for ethanol extract and the study lasted for 49 days.

**Table 1: Animal grouping and treatment**

| GROUPS | TREATMENT |
|---|---|
| 1 (Normal control) | Feed and water only throughout the duration of study. |
| 2 (Positive control) | Feed supplemented with hyperlipidemic diet formulation for 14 days then feed and water for the remaining days of the study. |
| 3 (ETH250mg ) | Feed supplemented with hyperlipidemic diet formulation for 14 days then treated with 250mg/kg b.w ethanol extract of *I.wombolu* seed for 28 days. |
| 4 (ETH500mg ) | Feed supplemented with hyperlipidemic diet formulation for 14 days then treated with 500 mg/kg b.w ethanol extract of *I.wombolu* seed for 28 days. |
| 5 (ETH1000mg ) | Feed supplemented with hyperlipidemic diet formulation for 14 days then treated with 1000mg/kg b.w ethanol extract of *I.wombolu* seed for 28 days. |

**Induction of hyperlipidemia**

Induction of hyperlipidemia was achieved by the method described by Onyeike *et al.* (2012) with a little modification. The animals were fed with normal rat chow supplemented with 2% egg yolk and 2% groundnut oil for 14days**.** The success of the induction was confirmed by analyzing for low density lipoprotein (LDL), high density lipoprotein (HDL), triglyceride (TG) and total cholesterol(TC) using blood samples of animals (three from each group)killed under anaesthesia.

**Determination of the Plasma Lipid Profiles/Indices**

Plasma total cholesterol (TC), HDL-cholesterol (HDLC) and triglyceride (TG) were assayed with commercial test kits (Biosystem Spain) following the manufacturer instruction. Plasma LDL-cholesterol was calculated using the Friedewald equation **(**Friedewald et al., 19 72), as follows:

*LDLC = TC – HDLC – TG/2.2. VLDLC = TG/2.2*

The level of Non-HDL density lipoproteins in the plasma were calculated using the method described by Brunzell et al., 2008) ;Non-HDL cholesterol = [TC] – [HDL]

The atherogenic indices were calculated as:

*Cardiac Risk Ratio (CRR) = TC/HDLC*

*Atherogenic Coefficient (AC) = (TC– HDLC)/HDLC*

*Atherogenic Index of Plasma (AIP)= log(TG/HDLC)*

**Statistical analysis**

All values were expressed as mean ± SD (standard deviation). SPSS software was used. One –way ANOVA test was performed and differences were considered significant at 95% confidence level ($P < 0.05$).

**RESULTS**

**High density lipoprotein (HDL) levels**

There was a significant decrease ($p<0.05$) in HDL level in all groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2, there was an increase in HDL level in all treatment groups (3-5) when compared to the positive control. Groups 5 was statistically significant ($p<0.05$) compared to the positive control. In phase 3, there was a significant ($p<0.05$) increase in HDL levels in treatment groups (3 and5) when compared to positive control as seen in Table 2.

**Table 2: High density lipoprotein (HDL) levels in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 0.96±0.08[b] | 0.97±0.10[b] | 1.00±0.20[b] |
| Positive control | 0.68±0.07[a] | 0.65±0.13[a] | 0.63±0.21[a] |
| ETH 250 | 0.67±0.38[a] | 0.77±0.12[a] | 0.83±0.15[a,b] |
| ETH 500 | 0.40±0.00[a] | 0.75±0.07[a] | 0.60±0.12[a] |
| ETH 1000 | 0.55±0.07[a] | 1.05±0.50[a,b] | 0.80±0.21[a,b] |

Values expressed as Mean ± S.D (n=3) at $p<0.05$ significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract.

**Low density lipoprotein (LDL) levels**

The result of LDL levels in hyperlipidemic animals fed with ethanol extract of *I.Wombolu* seeds in table 3, showed that there was a significant increase ($p<0.05$) in LDL level in groups 2-5 compared to the normal control after feeding with high fat diet. In phase 2, there was a significant decrease ($p<0.05$) in LDL level in groups 3-5 when compared to the positive control. In phase 3, there was a significant decrease ($p<0.05$) in LDL level in groups 4 when compared to the positive control.

**Table 3: LDL levels in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 1.24±0.16[b] | 1.38±0.03[b] | 1.77±0.68[b] |
| Positive control | 2.48±0.30[a] | 2.72±0.19[a] | 3.13±0.94[a] |
| ETH 250 | 2.90±0.62[a,b] | 2.33±0.40[a,b] | 2.23±0.16[a,b] |

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| | | | |
|---|---|---|---|
| ETH 500 | 2.80±0.69[a,b] | 1.85±0.07[a,b] | 2.85±0.33[a,b] |
| ETH 1000 | 2.80±0.14[a,b] | 2.00±1.13[a,b] | 3.11±0.14[a] |

Values expressed as Mean ± S.D (n=3) at p<0.05 significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Total cholesterol (TC) level**

Table 4 shows result of TC levels of hyperlipidemic induced animals fed with ethanol extract of *I. wombolu.* In phase 1, there was a significant increase (p<0.05) in TC level in all test groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2, there was a significant decrease (p<0.05) in TC level in all treated groups (3-5) when compared to the positive control. In phase 3, there was a significant decrease (p<0.05) in TC level in treated groups (3-4) when compared to the positive control.

**Table 4: Total Cholesterol (TC) levels in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 2.65±0.07[b] | 2.85±0.21[b] | 3.00±0.20[b] |
| Positive control | 4.00±0.26[a] | 4.00±0.10[a] | 4.40±0.90[a] |
| ETH 250 | 4.27±0.31[a,b] | 3.60±0.30[a,b] | 3.39±0.67[a,b] |
| ETH 500 | 3.97±0.50[a] | 3.15±0.21[a,b] | 4.00±0.10[a,b] |
| ETH 1000 | 3.90±0.14[a] | 3.45±0.64[a,b] | 4.50±0.42[a] |

Values expressed as Mean ± S.D (n=3) at p<0.05 significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Triglyceride (TG) levels**

Table 5 shows result of triglyceride (TG) levels in hyper lipidemic animals fed with ethanol extract of *I. wombolu.* In phase 1, there was a significant increase (p<0.05) in TG level in all groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2, there was a significant decrease (p<0.05) in TG level in all treated groups (3-5) when compared to the positive control. In phase 3, there was a significant decrease (p<0.05) in TG level in treated groups (3-4) when compared to the positive control.

**Table 5: TG levels in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 1.00±0.00[b] | 1.10±0.00[b] | 0.50±0.17[b] |
| Positive control | 1.38±0.30[a] | 1.38±0.17[a] | 1.40±0.60[a] |
| ETH 250 | 1.53±0.15[a,b] | 1.13±0.25[b] | 0.70±0.10[a,b] |
| ETH 500 | 1.73±0.68[a,b] | 1.15±0.21[b] | 1.20±0.12[a,b] |
| ETH 1000 | 1.15±0.21[b] | 0.90±0.00[b] | 1.30±0.14[a] |

Values expressed as Mean ± S.D (n=3) at p<0.05 significance level.

[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Very low density lipoprotein (VLDL) level**

Table 6 shows result of VLDL levels in the plasma of hyperlipidemic animals fed with ethanol extract of *I. wombolu.* In phase 1, there was a significant increase ($p<0.05$) in VLDL level in all groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2, there was a significant decrease ($p<0.05$) in VLDL level in all treated groups (3-5) when compared to the positive control. In phase 3, there was a significant decrease ($p<0.05$) in VLDL level in treated groups (3-4) when compared to the positive control.

**Table 6: VLDL levels in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 0.45±0.00[b] | 0.50±0.00[b] | 0.23±0.11[b] |
| Positive control | 0.64±0.10[a] | 0.63±0.06[a] | 0.64±0.14[a] |
| ETH 250 | 0.70±0.10[a] | 0.50±0.10[b] | 0.33±0.06[a,b] |
| ETH 500 | 0.77±0.31[a,b] | 0.55±0.07[b] | 0.55±0.06[a,b] |
| ETH 1000 | 0.55±0.07 | 0.40±0.00[b] | 0.59±0.07[a] |

Values expressed as Mean ± S.D (n=3) at $p<0.05$ significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Non- High density lipoprotein (Non-HDL).**

Table 7 shows result of Non-HDL levels of hyperlipidaemic induced animals fed with aqueous and ethanol extracts of *I wombolu.* In phase 1, there was a significant increase ($p<0.05$) in Non-HDL level in all groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2, there was a significant decrease ($p<0.05$) in Non-HDL level in all treated groups (3-5) when compared to the positive control. In phase 3, there was a significant decrease ($p<0.05$) in Non-HDL level in treated groups (3-4) when compared to the positive control.

**Table 7: NON-HDL levels in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 1.69±0.16[b] | 1.88±0.11[b] | 2.00±0.20[b] |
| Positive control | 3.32±0.23[a] | 3.35±0.15[a] | 3.77±1.07[a] |
| ETH 250 | 3.60±0.56[a,b] | 2.83±0.32[a,b] | 2.56±0.52[a,b] |
| ETH 500 | 3.57±0.50[a,b] | 2.40±0.14[a,b] | 3.4±0.15[a,b] |
| ETH 1000 | 3.35±0.07[a] | 2.40±1.13[a,b] | 3.7±0.64[a] |

Values expressed as Mean ± S.D (n=3) at $p<0.05$ significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control

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Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Cardiac risk ratio (CRR) levels**

Table 8 shows result of cardiac risk ratio levels of hyperlipidaemic induced animals fed with aqueous and ethanol extracts of *I. wombolu.* In phase 1, there was a significant increase ($p<0.05$) in cardiac risk ratio in all groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2 and 3, there was a significant decrease ($p<0.05$) in cardiac risk ratio in all treated groups (3-5) when compared to the positive control.

**Table 8: Cardiac Risk Ratio in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 2.78±0.32[b] | 2.94±0.08[b] | 3.07±0.59[b] |
| Positive control | 5.91±0.55[a] | 6.15±0.86[a] | 8.03±4.82[a] |
| ETH 250 | 7.77±3.86[a,b] | 4.76±0.79[a,b] | 4.06±0.09[a,b] |
| ETH 500 | 9.92±1.26[a,b] | 4.21±0.11[a,b] | 6.67±0.45[a,b] |
| ETH 1000 | 7.14±0.66[a,b] | 3.86±2.43[a,b] | 5.63±0.62[a,b] |

Values expressed as Mean ± S.D (n=3) at $p<0.05$ significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Atherogenic coefficient levels**

Table 9 shows result of atherogenic coefficient levels of hyperlipidaemic induced animals fed with aqueous and ethanol extracts of *I. wombolu.* In phase 1, there was a significant increase ($p<0.05$) in atherogenic coefficient in all groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2 and 3, there was a significant decrease ($p<0.05$) in atherogenic coefficient in all treated groups (3-5) when compared to the positive control.

**Table 9: Atherogenic Coefficient in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | 1.78±0.32[b] | 1.94±0.08[b] | 2.07±0.59[b] |
| Positive control | 4.91±0.54[a] | 5.15±0.86[a] | 7.03±4.82[a] |
| ETH 250 | 6.77±3.85[a,b] | 3.76±0.79[a,b] | 3.06±0.09[a,b] |
| ETH 500 | 8.92±1.26[a,b] | 3.21±0.11[a,b] | 5.67±0.45[a,b] |
| ETH 1000 | 6.14±0.66[a,b] | 2.86±2.43[a,b] | 4.63±0.62[a,b] |

Values expressed as Mean ± S.D (n=3) at $p<0.05$ significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Atherogenic index of plasma (AIP) level**

Table 10 shows result of atherogenic index of plasma in hyperlipidaemic induced animals fed with aqueous and ethanol extracts of *I. wombolu.* In phase 1, there was a significant increase ($p<0.05$) in

atherogenic index of plasma in all groups (2-5) compared to the normal control after feeding with high fat diet. In phase 2 and 3, there was a significant decrease ($p<0.05$) in atherogenic index of plasma in all treated groups (3-5) when compared to the positive control.

**Table 10: Atherogenic index of plasma in the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Normal control | $0.02\pm0.04^{b}$ | $0.06\pm0.05^{b}$ | $-0.31\pm0.09^{b}$ |
| Positive control | $0.30\pm0.13^{a}$ | $0.33\pm0.08^{a}$ | $0.35\pm0.17^{a}$ |
| ETH 250 | $0.40\pm0.23^{a}$ | $0.17\pm0.05^{a}$ | $-0.08\pm0.02^{a.b}$ |
| ETH 500 | $0.62\pm0.17^{a,b}$ | $0.18\pm0.04^{a}$ | $0.30\pm0.06^{a.b}$ |
| ETH 1000 | $0.32\pm0.03^{a}$ | $-0.04\pm0.21^{a,b}$ | $0.21\pm0.01^{a}$ |

Values expressed as Mean ± S.D (n=3) at $p<0.05$ significance level.
[a] means value is significantly different when compared to normal control
[b] means value is significantly different when compared to positive control
Phase 1= day 0 i.e after 14 days induction period, phase 2= after 14 days treatment period, phase 3= after 28 days treatment period. ETH= ethanol extract

**Changes in body weight**

Table 11 shows result of changes in body weight in hyperlipidaemic induced animals fed with aqueous and ethanol extracts of *I. wombolu.* In phase 1, there was a significant difference ($p<0.05$) in weight in groups 2-5 when compared to the normal control after feeding with high fat diet. In phase 2, group 3 showed a significant increase ($p<0.05$) in weight when compared to the positive control. In phase 3, group 4 showed a significant increase ($p<0.05$) in weight when compared to the positive control. In phase 4, group 4 and 5 showed a significant increase ($p<0.05$) in weight when compared to the positive control.

**Table 11: Changes in body weight of the test and control animals**

| Diet groups | Phase 1 | Phase 2 | Phase 3 | Phase 4 |
|---|---|---|---|---|
| Normal control | $65.63\pm12.94^{b}$ | $95.71\pm9.98$ | $108.00\pm18.12$ | $106.00\pm14.73^{b}$ |
| Positive control | $102.78\pm8.33^{a}$ | $106.56\pm16.85$ | $114.83\pm20.80$ | $123.67\pm26.08^{a}$ |
| ETH 250 | $58.33\pm12.50^{a,b}$ | $92.11\pm13.36^{b}$ | $122.83\pm15.84^{a}$ | $143.00\pm21.63^{a,b}$ |
| ETH 500 | $72.22\pm8.33^{a,b}$ | $101.00\pm17.10$ | $130.20\pm7.50^{a,b}$ | $130.00\pm2.65^{a,b}$ |
| ETH 1000 | $100.00\pm12.50^{a}$ | $112.83\pm23.47$ | $121.50\pm15.59^{a}$ | $149.00\pm18.38^{a,b}$ |

Values expressed as Mean ± S.D (n=3) at $p<0.05$ significance level.
[a]means value is significantly different when compared to normal control
[b]means value is significantly different when compared to positive control
Phase 1=weight after acclimatization, phase 2= weight at day 0 i.e after 14 days induction period phase 3= after 14 days treatment period, phase 4= after 28 days treatment period. ETH= ethanol extract

## DISCUSSION

Ethanol extract of *I. wombolu* seed (250mg/kg b.w) reduced triglyceride, LDL and total cholesterol levels while increasing HDL level at 14 days and 28 days of treatment. 500 and 1000mg/kg b.w dosesreduced triglyceride, LDL and total cholesterol levels while increasing HDL level at 14days and the reverse became the case at 28days of treatment. The initial reduction at 14 days on administration of ethanol extract may be due to the presence of flavonoids which reduced LDL thus increasing HDL or saponin-rich oil (Adedapo*et al.*, 2009**)** and polyphenols which have anti-hyperlipidemic

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properties (Grundy, 2004). These chemicals have been reported to influence enterohepatic circulation through sequestration and binding of bile acids (Behall, 1997). Analysis of volatile compounds in ethanolic extract of *I. Gabonensis* using GC/MS showed a high presence of fatty acids (Adedapo*et al*., 2009) which is composed of about 98.86% saturated fatty acids (Nangue*etal.,* 2011)as well as oils rich in saponins. The elevation in triglyceride, LDL and TC levels noted in ethanol extract (500 and 1000mg/kg b.w) at 28 days treatment may be due to accumulation of saturated fatty acids owing to the increased dosage and duration of treatment. Saturated fatty acid is known to elevate serum total cholesterol and LDL concentrations (Ginsberg *et al.,* 1998; Okafor et al., 2015).

Atherogenic indices serve as a powerful pointer of the risk of heart diseases. The lower the value, the lower the risk of developing cardiovascular disease and vice versa (Frohlich and Dobiásová, 2003).Ethanol extract dosages of 500 and 1000mg/kg b.w reduced atherogenic indices at 14 daysand increased it at 28 days of treatment. This suggests that ethanol extract (250mg/kg b.w) of *I.wombolu* seed is suitable for long-term usage as regards to prevention of cardiovascular disease whereas long term usage of 500and 1000mg/kg b.w increases the chances of developing cardiovascular diseases.

The animals increased in weight as treatment progressed to 28 days after treatment. This increase in weight may be due to their increase in age. This disagrees with the work of Ngondi *et al*. (2005) which suggested that extracts of *I. gabonensis* significantly decreased body weight of obese persons in Cameroun. Animals used for this study were not obese which may justify inability of the extracts to reduce weight. However agrees with the work of Hossain *et al*. (2012) showed that extracts of *I. gabonensis* had no effect on body weight of diabetic persons.

## CONCLUSION

Overall, the 250mg/kg b.w of the extract showed a progressive decrease in LDL, TG and TC level in addition to increase in HDL with values of 28 days lower than 14 days after treatment commenced. Ethanol extract (500 and 1000 mg/kg b.w) showed a decrease in LDL, TG and TC level as well as an increase in HDL at 14 days. However at 28 days after treatment, LDL, TG and TC level increased and HDL level decreased when compared to values obtained after 14 days treatment. This implies that the lower dose of the extract (250 g/kg b.w) has antidyslipidemic potential while the higher doses (500 and 1000 mg/kg b.w) has hyperlipidemic effect.

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