ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

Avocado Pear (*Persea americana*) Seed Ameliorated Altration In Some Hypertension Associated Biochemical Indices In Male Wistar Rats

Omodamiro O.D[1*], Ajah O[1]. Ewa-ibe C[1] and Jimoh M.A[2]
1. Pharmacology unit, Department of Biochemistry, Michael Okpara University of Agriculture, Umudike. Umuahia Abia State.
2. Department of Plant Biology, Osun State University, Osogbo.

Abstract

Hypertension is a major health problem throughout the world because of its high prevalence and its association with increased risk of cardiovascular disease. It is usually taken as that level of arterial blood pressure associated with doubling of long-term cardiovascular risk. This study evaluated the anti-hypertensive potential of ethanol extract of *Persea americana* seed (avocado pear) in male Wistar albino rats. Twenty-four rats were used for this study and they were divided into 6 groups of 4 rats each. Group 1 (normal control), group 2 (hypertensive untreated), group 3 (hypertensive + 10mg/kg b.w of frusemide, a standard anti-hypertensive drug), group 4 through 6 were hypertensive rats administered 200mg/kg, 400mg/kg and 600 mg/kg b. wt of extract. The hypertension was induced by oral administration of 1ml of 18% NaCl for three (3) weeks. The results showed significant ($p<0.05$) Increase in the VLDL, TAG, Uric acid, Na^+ concentration in the untreated group compared to the normal control and extract treated group. *P. americana* aqueous seed extract showed significant ($p<0.05$) increase in HDL of treated group compared to untreated group. These results validate the forklore use *P. americana* seed in the management of hypertension.

Keywords: Hypertension, *Persea americana* seed, ameliorate, biochemical indices

INTRODUCTION

Hypertension and dyslipidemia are major risk factors for cardiovascular disease, accounting for the highest morbidity and mortality (Kamrun *et al.*, 2014). Hypertension is a major health problem throughout the world because of its high prevalence and its association with increased risk of cardiovascular disease. It is usually taken as that level of arterial blood pressure associated with doubling of long-term cardiovascular risk (Kaplan, 2002; Chobanian, 2003). It is widely accepted that CVD is associated with hypertension and increased blood levels of low-density lipoprotein (LDL), total cholesterol (TC), and triglycerides (TG). In contrast, a low level of high density lipoprotein (HDL) is a risk factor for mortality from CVD (Mora *et al.*, 2013).

Medicinal plants have attracted numerous attentions globally, plants parts including seeds, leaves, stems, roots and barks etc are used for the treatment of many diseases affecting humans (Sofowora, 2008). This is as a result of the continuous need for less expensive means of disease control. Again, many drugs commonly used today are of herbal origin because of their safety, quality, and efficacy. Indeed, about 25% of the prescription drugs dispensed contain at least one active ingredient derived from plant material.

Avocados are a rich source of nutrients and phytochemicals. Some scientific records on the pharmacological activities of the avocado pear include its vasorelaxant activity (Owolabi *et al.*, 2005), hypotensive activity, analgesic and antiinflammatory activity (Adeyemi *et al.*, 2002), antiviral activity, anticonvulsant effect (Ojewole and Amabeoku, 2006), antiulcer effect (Ukwe and Nwafor, 2004), wound healing activity (Nayak *et al.*, 2008), antihepatotoxic activity, antioxidant activity, hypoglycemic activity (Anita *et al.*, 2005) and effect on body weight (Pliego and Litz, 2007; Brai *et al.*, 2007) . However, there is limited scientific evidence on its effect on hypertension associated biochemical risk factor in high salt induced hypertension in rats. This gave rise to this study.

MATERIALS AND METHODS

MATERIALS

Collection and identification of plant material

The pear (*Persea americana*) seeds were collected from a garden in Umudike, Abia State and identified by Mr. Ibe Ndukwe of the Department of Forestry and Environment in Michael Okpara University of Agriculture, Umudike in Abia State, Nigeria.

Animals

Twenty four matured male wistar rats (150-180g) were used for the experiment. The animals were obtained from the Animal Production Unit of College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike. The animals were housed in well-aerated laboratory cages and allowed to acclimatize in the new environment for seven days before the commencement of the studies. They were maintained on standard animal feeds and drinking water *ad libitum* until the end of the studies. Care of experimental animals was taken as per the guidelines

given by Committee for the Purpose of Control and Supervision on Experiments on Animals (CPCSEA), Ministry of Environment and Forests (Animal Welfare Division), Umuahia Abia State, Nigeria.

Preparation of ethanol extract of the plant material

The samples were washed under running water while the seeds were separated from the flesh, chopped into small pieces by table knife, air dried and milled. The ethanol extract of the samples were subsequently prepared by soaking the powdered samples in ethanol for about 72 hours at 37°C with constant shaking, the mixture was filtered and later dried in water bath at the temperature of 4ºC. The extract was then stored in the refrigerator for subsequent analysis (Unegbu *et al.*, 2017)

Induction of hypertension

About 18% of sodium chloride (salt) was prepared and 1ml of the solution was concomitantly administered to the rats for 21 days.

Experimental design

Twenty-four (24) mature male Wistar rats were randomly divided into six groups of four animals each as shown below:

Group 1 (Normal control): Rats were fed with normal diet and water *ad libitum* only for twenty one (21) days.

Group 2 (Hypertensive untreated): 1ml of 18% sodium chloride solution only for 3 weeks.

Group 3: Rats were given 1ml of 18% sodium chloride solution + 100mg/kg body weight of Frusemide (a standard anti-hypertensive drug).

Group 4: Rats were given 1ml of 18% sodium chloride solution + 200mg/kg body weight of ethanol extract of avocado pear seed.

Group 5: Rats were given 1ml of 18% sodium chloride solution + 400mg/kg body weight of ethanol extract of avocado pear seed.

Group 6: Rats were given 1ml of 18% sodium chloride solution + 600mg/kg body weight of ethanol extract of avocado pear seed.

Assay of lipid profile

Component lipids – Cholesterol, HDL- Cholesterol (HDL-C), triacylglycerol (TAG), VLDL-cholesterol (VLDL-C) and LDL-Cholesterol (LDL-C) were determined using standard commercial test kits obtained from RANDOX Laboratories, Co-Antrim, United Kingdom.

Statistical analysis

Statistical analysis was performed with analysis of variance (ANOVA). The results are expressed as mean ±SEM, and LSD test was used to test for significant difference between means with $p<0.05$ considered significant.

RESULTS AND DISCUSSION

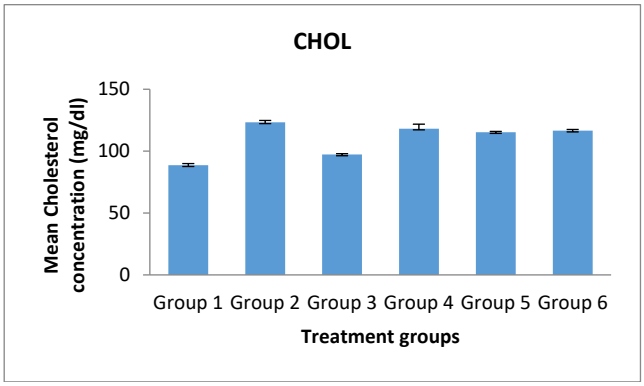

Figure 1: effect of ethanol extract of Avocado pear seed on Cholesterol

The result revealed significant ($p<0.05$) increase in cholesterol level of the group 2 compared to the group 1 (normal control) and there was significant ($p<0.05$) decrease in the extract groups (4, 5 and 6) and standard drug (group 3) compared to negative control (group 2).

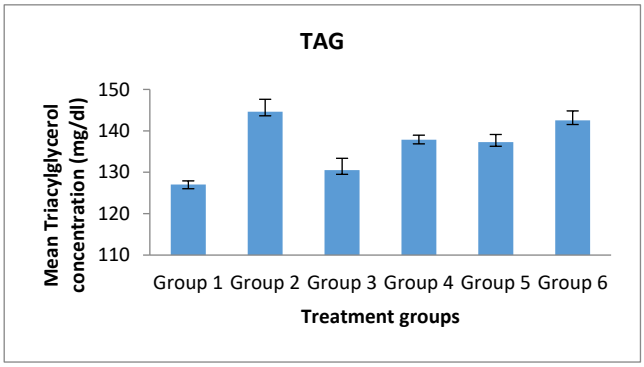

Figure 2: effect of ethanol extract of Avocado pear seed on Triacylglycerol (TAG)

The result revealed significant ($p<0.05$) increase in TAG level of the group 2 compared to the group 1 (normal control) and there was significant ($p<0.05$) decrease in the extract groups (4, 5 and 6) and standard drug (group 3) compared to negative control (group 2).

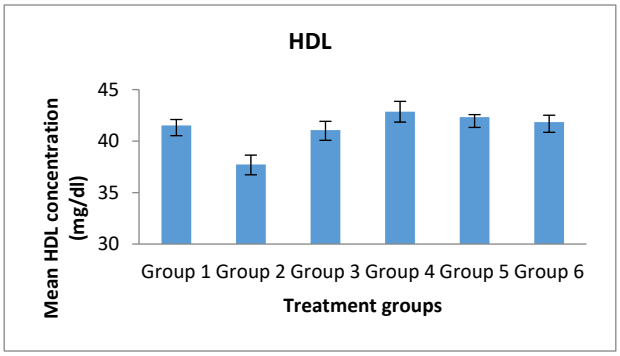

Figure 3: effect of ethanol extract of Avocado pear seed on High density lipoprotein

The result revealed significant ($p<0.05$) decrease in HDL level of the group 2 compared to the group 1 (normal control) and there was significant ($p<0.05$) increase in the extract groups (4, 5 and 6) and standard drug (group 3) compared to negative control (group 2).

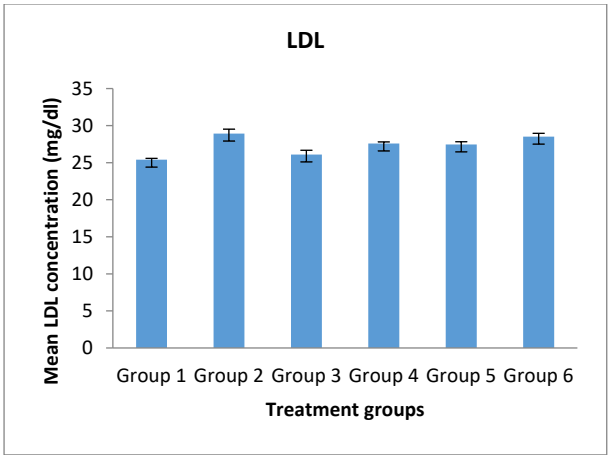

Figure 4: effect of ethanol extract of Avocado pear seed on Low density lipoprotein

The result revealed significant ($p<0.05$) increase in LDL level of the group 2 compared to the group 1 (normal control) and there was significant ($p<0.05$) decrease in the extract groups (4, 5 and 6) and standard drug (group 3) compared to negative control (group 2).

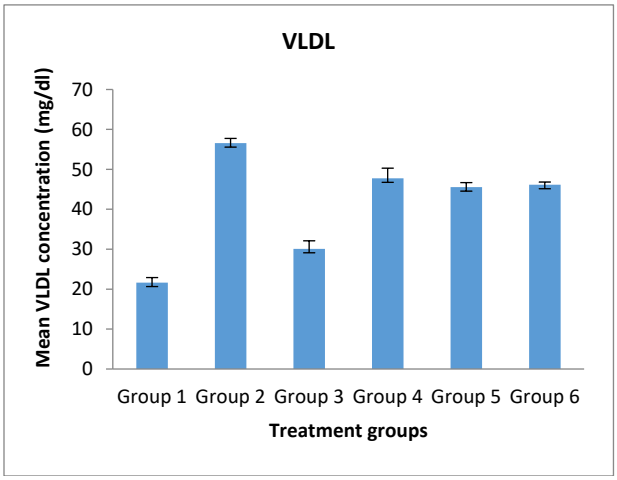

Figure 4.5: effect of ethanol extract of Avocado pear seed on Very low density lipoprotein

The result revealed significant ($p<0.05$) increase in cholesterol level of the group 2 compared to the group 1 (normal control) and there was significant ($p<0.05$) decrease in the extract groups (4, 5 and 6) and standard drug (group 3) compared to negative control (group 2).

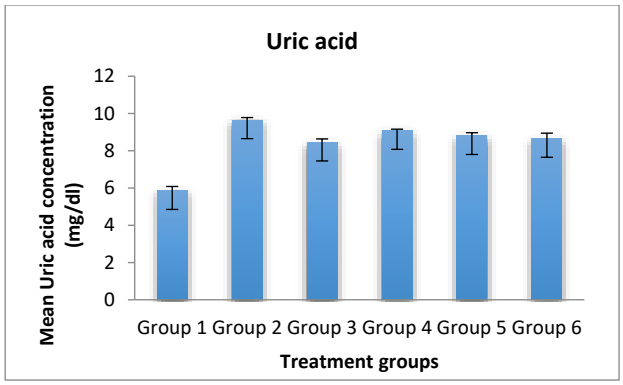

Figure 6: effect of ethanol extract of Avocado pear seed on uric acid

The result revealed significant ($p<0.05$) increase in uric acid level of the group 2 compared to the group 1 (normal control) and there was significant ($p<0.05$) decrease in the extract groups (4, 5 and 6) and standard drug (group 3) compared to negative control (group 2).

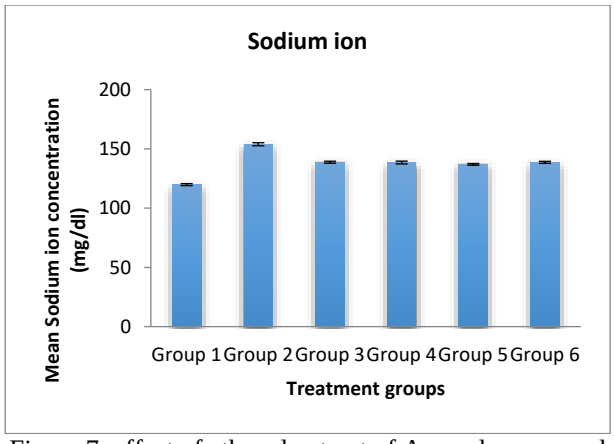

Figure 7: effect of ethanol extract of Avocado pear seed on sodium ion concentration

The result revealed significant ($p<0.05$) increase in sodium ion level of the group 2 compared to the group 1 (normal control) and there was significant ($p<0.05$) decrease in the extract groups (4, 5 and 6) and standard drug (group 3) compared to negative control (group 2).

DISCUSSION

This study evaluated the effect of avocado pear seed on the lipid profile and some other hypertension risk biochemical indices in high salt induced hypertension in wistar rats.

Hypertension, damages the endothelium through altered sheer stress and oxidative stress, resulting in increased endothelial cell synthesis of collagen and fibronectin, reduced nitric oxide-dependent vascular relaxation, and increased permeability to lipoprotein. It is also associated with an upregulation of lipid oxidation enzymes, especially oxidized LDL contributing to

atherosclerosis (O'Donnell, 2003; Rekha and Prasad, 2016). it has been suggested that low density lipoprotein (LDL) cholesterol in itself may be a modifiable risk factor for hypertension (Kaare and Dag, 1991).

Reduction in cholesterol, triacylglycerol, LDL and VLDL levels by avocado seed in this study is in line with the report of Dunbar, (2006). The cholesterol and LDL reducing potential of avocado seed could be attributed to high content of monounsaturated fatty acids, beta sitosterol, Carotenoids present in the pulp of avocado pear. Monounsaturated fats have neutral influence on blood cholesterol concentrations leading to neither a rise nor a fall when administered to volunteers, High levels of monounsaturated and polyunsaturated fatty acids could be responsible for the cholesterol lowering effect of avocado seeds (Hornstra and Sundram, 1991).

Increase in the lipid profile parameter, sodium ion and uric acid levels observed in the group 2 (administered 18% salt only) compared extract treated and standard drug control could be attributed to the hypertensive state of the rats (Jung *et al.*, 2006).

CONCLUSION

These results justify the use of extract of *Persea americana* seed as an effective supplement in the management of hypertensive.

REFERENCES

1. Adeyemi, O. O., Okpo, S. O. and Ogunti, O. O. (2002) Analgesic and anti-inflammatory effects of the aqueous extract of leaves of *Persea americana* Mill (Lauraceae). *Fitoterapia*. **73**: 375 – 380.
2. Ahmad, M., Saeed, A. M., Alam, H. and Asghar, Z. (1992). Biological effects of indigenous medicinal plants 2. Effects of Aplotaxis lappa Dcne on various parameters of liver metabolism in rabbits. *Journal of Islamic Academy of Science*,**5**: 61 - 66.
3. Anita, B. S., Okokon, J. E. and Okon, P. A. (2005). Hypoglycemic activity of aqueous *Persea Americana* Mill. *Indan Journal of Pharmacology*,**37**: 325 – 326.
4. Brai, B. I., Odetola, A. A. and Agomo, P. U. (2007). Effects of *Persea americana* leaf extracts on body weight and liver lipids in rats fed hyperlipidaemic diet. *African Journal of Biotechnology*,**6**: 1007 – 1011.
5. Chobanian, A. V. (2003). Seventh report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure. *Hypertension*, **42**:1206–1252.
6. Ding, H., Chin, Y. W., Kinghorn, A. D. and Ambrosio, S. M. (2007). Chemopreventive characteristics of avocado fruit. *SeminalCancerBiology*, **17**(5): 386 - 394.
7. Dunbar, R. L. (2006). Hypertension and lipid profile In: R. Emile Mohler and R. Raymond, Townsend, Advanced therapy in hypertension and vascular disease. PMPH - USA., pp: 364-370.
8. Dawson, J., Jeemon, P., Hetherington, L., Judd, C., Hastie, C. and Schulz, C. (2013). Serum uric acid level, longitudinal blood pressure, renal function, and long-term mortality in treated hypertensive patients. *Hypertension*,**62**: 105 – 111.
9. Feig, D. I., Madero, M., Jalal, D. I., Sanchez-Lozada, L. G. and Johnson, R. J. (2013). Uric acid and the origins of hypertension. *Journal of Paediatric*,**162**: 896 – 902.
10. Frisinghelli, A. and Mafrici, A. (2007). Regression or reduction in progression of atherosclerosis, and avoidance of coronary events, with lovastatin in patients with or at high risk of cardiovascular disease: A review. *Clinical Drug Investigation*,**27**: 591-604.
11. Govanucci, E. (2007). Does prostate specific antigen screening influence the results of studies of tomatoes, lycopene and prostate cancer risk? *Journal of National Cancer Institute*, **99**(14): 1059 - 1069.
12. Hornstra, G. and Sundram, I. C. (1991). The influence of dietary palm oil on cardiovascular risk factors: a human study. PORIM International oil conference 9 - 14 sept., Kuala, Lumpur, Malaysia, pp: 154-55.
13. Jung, W. K., Mendis, E., Je, J. Y., Park, P. J., Son, B. W. and Kim, H. C. (2006). Angiotensin I converting enzyme inhibitory peptide from yellowfin sole (*Limanda aspera*) frame protein and its antihypertensive effect in spontaneously hypertensive rats. *FoodChemistry*, **94**: 26 – 32.
14. Kaplan, N. M. (2002). Kaplan's clinical hypertension. 8th ed. Philadelphia, Lippincott Williams and Wilkins.
15. Laclaustra, M., Frangi, A. F., Casasnovas, J. A. and Cia, P. (2007). Association of endothelial function and vascular data with LDL-C and HDL-C in a homogenous population of middle-aged, healthy military men: Evidence for a critical role of optimal lipid levels. *International Journal of Cardiology*, 2: 23 - 28.
16. Lippi, G., Montagnana, M., Franchini, M., Favaloro, E. J. and Targher, G. (2008). The paradoxical relationship between serum uric acid and cardiovascular disease. *Clinica Chemistry Acta*, **392**: 1 – 7.
17. Marian, V., Dieter, L., Jan, M., Mark, T. D. C., Milan, M. and Joshua, T. (2007). Free radicals and antioxidants in normal physiological functions and human disease. *The International Journal of Biochemistry and Cell Biology*, **39**(1): 44 – 84.
18. Mazzali, M., Kanellis, J., Han, L., Feng, L., Xia, Y. and Chen, Q. (2002). Hyperuricemia induces a primary renal arteriolopathy in rats by a blood pressure-independent mechanism. *American Journal of Physiology and Renal Physiology*,**282**: 991 – 997.
19. Mora, S., Glynn, R.J. and Ridker, PM. (2013). High-density lipoprotein cholesterol, size, particle number, and residual vascular risk after potent statin therapy. *Circulation*, **128**(11):1189–1197.
20. Nayak , B. S., Raju, S. S. and Rao, C. V. (2008). Wound healing activity of *Persea americana* (avocado) fruit: A preclinical study on rats. *Journal of Wound Care*, **17**:123 – 125.
21. Oboh, G., Puntel, R. L. and Rocha, J. B. T. (2007). Hot pepper (Capsicum annuum, Tepin and Capsicum chinese, Habanero) prevents Fe^{2+}- induced lipid peroxidation in brain *in vitro*. *FoodChemistry*, **2**: 178–185.
22. Oboh, G. and Rocha, J. B. T. (2008). Hot pepper (Capsicum spp.) protects brain from sodium nitroprusside- and quinolinic acidinduced oxidative stress *in vitro*. *Journal of Medicinal Food*, **11**: 349 – 355.
23. O'Donnell, V.B. (2003). Free radicals and lipid signaling in endothelial cells. *Antioxid Redox Signal* **5**:195-203.
24. Ojewole, J. A. and Amabeoku, G. J. (2006). Anticonvulsant effect of *Persea americana* Mill (Lauraceae) (Avocado) leaf aqueous extract in mice. *Phytotherapy Research*,**20**: 696 –700.
25. Owolabi, M. A., Jaja, S. I. and Coker, H. A. (2005). Vasorelaxant action of aqueous extract of the leaves of *Persea americana* on isolated thoracic rat aorta. *Fitoterapia*, 76: 567 – 573.
26. Pliego, A. F. and Litz, R. E. (2007). California Avocado Society Yearbook. Pp. **90**: 149 – 167.
27. Rekha, K. and Prasad, R.R. (2016). Effect of Hypertension on Lipid Profile of Individuals of Bihar State. *Int J Sci Stud*, **4**(5):197-199.
28. Rodriguez-Iturbe, B., Romero, F. and Johnson, R. J. (2007). Pathophysiological mechanisms of salt-dependent hypertension. *American Journal of Kidney Diseases*,**50**: 655 – 672.
29. Sanchez-Lozada, L. G., Tapia, E., Santamaria, J., Avila-Casado, C., Soto, V. and Nepomuceno, T. (2005). Mild hyperuricemia induces vasoconstriction and maintains glomerular hypertension

in normal and remnant kidney rats. *Kidney International*,**67**: 237 – 247.

30. Sofowora, A. (2008). Medicinal Plants and Traditional Medicine in Africa. Spectrum Books, Ibadan 150.
31. Soletsky, B. and Feig, D. I. (2012). Uric acid reduction rectifies prehypertension in obese adolescents. *Hypertension*,**60**: 1148 – 1156.
32. Ukwe, C. V. and Nwafor, S. V. (2004). Anti-ulcer activity of aqueous leaf extract of *Persea Americana* (family-Lauraceae). *Nigerian Journal Pharmaceutical Research*,**3**: 91 – 95.
33. Walters, J. L., Gail, M. H., Weinstein, S. J., Vitamo, J. and Albanes, D. (2009). Association between (alpha) - tocopherol, (beta) - carotene and retinol and prostate cancer survival. *CancerResearch*, **69**(9): 3833 - 3841.
34. Wood, R. (1988). The whole foods encyclopedia, New York NY: Prentice- Hall press. PMID: 15220.
35. Zoccali, C. and Mallamaci. F. (2013). Uric Acid, Hypertension, and Cardiovascular and Renal Complications. *Current Hypertension Report*,**15**: 531.