Biosciences, Biotechnology Research Asia Vol. **7**(1), 133-137 (2010)

The effect of aqueous extract of *P. americana* Mill. (Avocado) seeds on blood pressures and electrolytes in hypertensive rats

KATE E. IMAFIDON[1]* and P. IGBINADUWA

[1]Biochemistry Department, Faculty of Life Sciences, University of Benin, Benin City, Edo state (Nigeria).
Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Benin, Edo state (Nigeria).

(Received: September 03, 2009; Accepted: October 13, 2009)

ABSTRACT

The effects of aqueous seed extract of *Persea americana* Mill. (avocado) on blood pressures and electrolytes of albino rats have been studied. Twenty rats were divided into 4 groups of 5 rats each. Group1 (normal control), group 2 (hypertensive control), group 3 (hypertensive + 200 mg/kg body weight of extract), and group 4 (hypertensive + 500 mg/kg body weight of extract). Except for group 1 which received 100% growers mash, all other groups received 92% growers mash and 8% NaCl as their daily meal for 4 weeks. Results showed a significant ($P<0.05$) reduction in blood pressures and sodium concentration of rats administered aqueous seed extract of avocado compared with the hypertensive control. Potassium and magnesium levels of tested rats were not significantly altered compared with normal control while calcium levels were significantly increased in tested rats compared with normal control. These results demonstrate the antihypertensive and sodium lowering effect of avocado seed extract.

Key words: Avocado, blood pressure, electrolyte, hypertensive, seed.

INTRODUCTION

High blood pressure is one of the major risk factors of atherosclerosis and its complications mainly coronary and cerebrovascular diseases. Proper balance of electrolytes is essential for heart function, blood pressure, fluid absorption and excretion and muscle coordination[1]. The kidney regulates fluid absorption and excretion and maintains a narrow range of electrolyte fluctuation[2]. Studies have revealed a change in the electrolyte distribution of experimental organism fed on high salt diet which seem to correlate with increase in blood pressures of these animals, these electrolytes concentrations have been shown to be reversed by antihypertensive treatment.[3]

The antihypertensive properties of a variety of medicinal plants have been demonstrated e.g. mistletoe[4], *Carica papaya*,[5] *Allium sativa,*[6] and *Jatropha curcas*.[7] *P. americana* of the family Lauraceae, is a native fruit of Mexico and Central America. The fruit is commonly refered to as avocado pear, alligator pear or butter fruit. There are dozens of varieties of avocado which fall into three main categories, Mexican, Guatemaleen and West Indian, which differ in their size, appearance, quality and susceptibility to cold. The most popular type of avocado in the United States is the Hass variety, which has brown-black skin, another common type is the Fuerte, which has smooth dark green skin and a more defined pear shape[8].

Leaf juices and concoctions of avocado have been used as antibiotics, treatment for hypertension, diarrhoea, sore throat and to regulate menstruation[9, 10]. Aqueous seed extract of this plant have been used by most medicine practitioners in Nigeria in the treatment of hypertension. This work was done to justify the use of avocado seed in the treatment of hypertension and to determine its effect on some serum electrolytes.

MATERIAL AND METHODS

Source of plant materials

Fresh fruits of avocado were purchased from Oba market, Benin City, Edo state, Nigeria, West Africa.

Preparation of plant extract

The seeds were removed, chopped into smaller pieces and dried in an oven at 40° for six hours. Two kilograms of the dried seeds were pulverized and stored in a refrigerator at 4°. Daily 30g of the powder was dissolved in 100 ml of distilled water and sieved, the filtrate was administered orally.

Treatment of animals

Twenty albino rats were divided into 4 groups of 5 rats each. The animals were acclimatized for 1 week after which animals in group 1 (normal control), were given growers mash only, and animals in other groups were given 92% growers mash and 8% NaCl to induce hypertension.[11] While groups 1 and 2 were given equivalent volume of water, animals in group 3 (hypertensive + 200 mg/kg), were given 200 mg/kg body weight (b. wt) of aqueous avocado seed extract while group 4 (hypertensive + 500 mg/kg) were given 500 mg/kg b. wt of avocado seed extract for a period of 4 weeks. The body weight of animals were taken and recorded weekly.

After 4 weeks, the blood pressures of animals were measured using a 2-channel recorder (Gemini, 7070).The rats were anaesthesized by intraperitoneal injection of urethane. The trachea and carotid artery (either left or right) were exposed and cannulated, the arterial cannula was then connected to a 2-channel recorder. The respective systolic and diastolic pressures were then read using a Sphyganomanometer. The pulse pressures and arterial mean pressures were obtained by calculations. [12] The rats were dissected and blood pressures were collected for further analysis.

Biochemical analysis

Sodium and potassium levels were estimated using emission flame photometer (Corning, 410^{0}C).[13] Assay kits (Quimica Clinica Applicada and Linear Chemicals, Spain) were used for calcium and magnesium estimation. Calcium was estimated based on the O-cresolpthalein method [14] while magnesium was estimated based by the Calmagite method [15].

Statistical analysis

All data were expressed as mean ± standard error of mean. Analysis of variance (ANOVA) was used to test for difference among all the groups. Least significant difference test was used to test for the significant differences among the means, a P value of 0.05 was considered statistically significant.

RESULTS

Table 1 shows the weight gain, amount of feed intake and faecal output of rats administered aqueous extract of avocado seeds. There were significant ($P<0.05$) reduction in food intake and faecal output of rats administered 200 mg/kg and 500 mg/kg aqueous avocado seed extract compared with the normal and hypertensive control. Weight gained by rats administered aqueous avocado seed extract differed insignificantly ($P>0.05$) compared with the normal control.

Table 2 shows the blood pressures of rats administered the aqueous avocado seed extract, there were significant ($P<0.05$) increases in systolic, diastolic, pulse and mean arterial pressures of the hypertensive control rats compared with the normal control. Hypertensive rats administered 200 mg/kg and 500 mg/kg b. wt of extract had significantly ($P<0.05$) reduced systolic, diastolic, pulse and mean arterial pressures compared with the hypertensive control. Results of serum electrolyte levels of rats (table 3) shows significant increase in calcium levels of hypertensive control rats and those groups of hypertensive rats administered aqueous extract of avocado seeds compared with the normal control. Magnesium levels of both control and tested rats were not significantly altered. Sodium levels of hypertensive control rats were significantly higher than the normal control. At the 200 mg/kg dose level, sodium levels of rats were significantly higher than the normal control while at the 500 mg/kg dose level; sodium levels of rats were significantly lower. Potassium levels of rats administered the aqueous avocado seed extract differed insignificantly compared with the normal control.

Table 1: Weight gain, food intake and faecal output of rats administered aqueous avocado seed extract

Group	Weight gain(g)	Food intake(g)	Faecal output(g)
Normal control	19.3±3.1	62.7±5.7	38.5±4.2
Hyp. Control	15.0±3.5*	59.3±1.7	31.7±2.9*
Hyp +200 mg/kg	19.0±4.5	38.7±1.5*	19.2±3.7*
Hyp. + 500 mg/kg	17.5±1.2	40.8±2.7*	19.1±2.9*

Results are expressed as mean ± SEM (n=5). * Significance at P<0.05 compared with normal control.

Table 2: The blood pressures of rats administered aqueous avocado seed extract

Group	Systolic (mmHg)	Diastolic (mmHg)	Pulse (mmHg)	Mean arterial pressure (mmHg)
Normal control	81.0±3.1	52.3±4.3	28.7±1.9	60.2±4.0
Hyp. Control	166.0±5.1*	128.0±6.1*	74.0±5.1*	140.6±6.5*
Hyp + 200 mg/kg	145.0±2.8*	76.6±11.6*	68.4±10.0*	99.4±2.3*
Hyp.+ 500 mg/kg	125.0±21.5*	56.4±4.0	68.6±3.1*	79.2±4.5*

Results are expressed as mean ± SEM (n=5). * Significance at P<0.05 compared with normal control.

Table 3: Serum electrolyte levels of rats administered aqueous extract of avocado seed

Group	Calcium (mmol/L)	Magnesium (mmol/L)	Sodium (mmol/L)	Potassium (mmol/L)
Normal control	1.17±0.5	2.08±0.3	150.4±11.9	5.8±1.2
Hyp. Control	1.79±0.9*	2.37±0.4	164.0±5.1*	6.0±1.5
Hyp + 200 mg/kg	1.77±0.8*	2.29±0.6	155.5±3.4*	5.4±0.9
Hyp.+ 500 mg/kg	1.55±0.2*	2.08±0.9	145.0±5.1*	5.2±1.0

Results are expressed as mean ± SEM (n=5). * Significance at P<0.05 compared with normal control.

DISCUSSION

The effects of aqueous avocado seed extract on weight gain, food intake, blood pressures and electrolyte levels were studied. Weight gained by rats administered 200 mg/ kg and 500 mg/kg aqueous avocado seed extract differed insignificantly (P>0.05) Compared with the normal control. There were significant reduction in food intake and corresponding faecal output of rats administered the different doses of the aqueous avocado seed extract. These data suggest the presence of an appetite depressant in avocado and it is consistent with the report of some workers[8]. Significant (P<0.05) increases in blood pressures associated with salt loaded rats indicate that hypertension was induced. Salt loading had been shown to cause hypertension[16,17].

Administration of aqueous avocado seed extract at the different doses significantly reduced systolic, diastolic, pulse and mean arterial blood pressures compared with the hypertensive control. Blood pressure lowering effect of avocado pulp and

leaves has been reported by some workers[9, 10, 18]. The blood pressure lowering effect of avocado has been attributed to their high content of potassium[18]. Potassium dilates the blood vessels and regulates blood pressures and sodium concentration[19].

Increased sodium concentration compared with the normal control was associated with the hypertensive control although the potassium concentration differed insignificantly compared with the normal control. This shows increased salt retention in the hypertensive rats. The result of increased salt retention in hypertensive is in agreement with the report of some workers[20]. A significant ($P<0.05$) reduction in sodium levels compared with the hypertensive control was observed on administration of the aqueous seed extract. This shows that avocado seed extract promotes increased excretion of sodium ion by the kidney and this must have been responsible for the blood pressure lowering effect of avocado seed extract.

The potassium levels of rats administered the different doses of aqueous avocado seed extract were not significantly altered compared with the normal control. This is expected as any significant deviation from the normal value may result in serious illness[21]. Potassium absorbed by the intestinal tract causes only a slight and temporary increase in serum potassium levels, only a fraction of this potassium moves into the cell, the excess is rapidly excreted by the kidney[22]. This mechanism protects the body against high serum potassium levels which could cause serious changes in muscles irritability and respiration and may cause myocardial infarction[22].

Magnesium levels of tested and control rats were not significantly altered; however calcium levels were significantly increased in hypertensive and tested rats compared with control. Increase in calcium levels in rats administered the different doses of aqueous avocado seed extract differed insignificantly ($P>0.05$) compared with the hypertensive control, this shows that high calcium levels associated with the hypertensive rats could not be reversed by the administration of the seed extract. In patients and experimental animals with arterial hypertension, many abnormalities of calcium metabolism have been reported[1].

This work justifies the traditional use of avocado seed extract in the treatment of hypertension. The possible mechanism of action may be increased sodium excretion by the kidney. In addition, the presence of appetite depressant makes the aqueous seed extract useful in the treatment of obesity. Further work will be carried out to identify and characterize the chemical components responsible for its pharmacological actions.

REFERENCES

1. Young, D. B., Lin, H. and McCabe, R. D. *Am. J. Physiol*. **268**: 825-837 (1995).
2. Tobian, L. *Am. J. Clin. Nutr*. **32**: 2739-48 (1997).
3. Dahl, L. K. Essential hypertension. Back, K. D and Cottler, P. T. (eds). Springer, Berlin. 53 (1960).
4. Al-Achi, A. *US Pharm*. **1**: 12-18 (2005).
5. Akah P. A, Oli, N. A and Gamaniel, K. *Fito.* **4**: 327-31 (1997).
6. Duke, J.A. CRC. *Handbook of medicinal herbs. Roca Raton.* 228-29 (1985).
7. Sofowora, A. Medicinal plants and traditional medicine in Africa. Spectrum books Ltd. Ibadan. 2nd ed. 64-71 (1993).
8. Naveh, E., Werman, M. J., Sabo, E and Neeman*, J. J. Nutr.* **132**: 2015-18 (2002).
9. Craignil, A. L. *Vet. Hum. Toxicol*. **26**: 381 (1984).
10. Crisi, G. and Belsito, D. V. *Contact Derm*. **28**:247-48 (1995).
11. Obiefuna, P.C.M., Sofola, O. A. and Ebeigbe, A. B. Nig. *J. Physiol. Sci*. **8**: 54-57 (1992).
12. Fabian, C. A. and Omogbai, E.K. *Acta Polo.*

Pharma. **64**(6): 547-52 (2007).
13. Tietz, N. Clinical guide to laboratory tests. 3rd ed, W. B. Saunders, Company, Philadelphia. 518-519 (1995).
14. Gitelman, H. *J. Annal. Biochem.* **18**: 521-31 (1967).
15. Eleftherius, Z., Georgios, J., Kostag, P., Panagitix, P., Nikki, G. and Stelios, *J. Chest* **123**: 113-18. 2003.
16. Obiefuna, P. C. M. Sofola, O.A. and Ebeigbe, A. B. *Exper. Physiol*. **76**: 136-38 (1991).
17. Sofola, O. A., Aina, T. A., Egbe, T. E and Owolabi, O. A. Nig. *J. Physiol. Sc.* 7: 95-97 (1991).
18. Takano, J. http://wwwpyrogen.com/article07/avocadohealthbenefits.htm (2009).
19. Wood, R. The whole Foods Encyclopedia, New York. NY: Prentice Hall press. PMID,15220 (1988).
20. He, J. Whelton, P.K. and Appel, *I. J.Hyper*. **35**: 544-49 (2000).
21. Guyton, A. C. and Hall, *J. E. Am. J. Med*. **52**: 584 (1972).
22. Tietz, N. W. Fundamentals of Clinical Biochemistry, W. B. Saunders company, London. 847-917 (1982).