Liver Function Status of Hypertensive and Normotensive Rats Administered Persea americana Mill. (Avocado) Seeds

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Abstract: The effects of aqueous seed extract of Persea americana var. fuerte (avocado) on body weight, blood pressure, serum levels of total protein, albumin, alkaline phosphatase, alanine and aspartate aminotransferases were investigated. Thirty albino rats were divided into six groups of 5 rats each; group 1 (normal control), group 2 (hypertensive control), group 3 (hypertensive+200 mg/kg), group 4 (hypertensive+500 mg/kg), group 5 (hypertensive+700 mg/kg) and group 6 (normal+200 mg/kg). Except for group 1 and 6, which received 100% growers mash, all other groups received 92% growers mash and 8% NaCl as their daily meal for 4 weeks. Results showed significantly (P<0.05) reduced weight gain of normal rats administered the aqueous seed extract compared with the normal control. Avocado seeds significantly reduced blood pressures of rats at all dose levels compared with the hypertensive control. The blood pressures of normal rats were significantly reduced compared with the normal control. There were no significant (P>0.05) differences in protein, albumin, alanine and aspartate aminotransferases of normal and hypertensive rats administered the different doses of the aqueous seed extract. Alkaline phosphatase activity were significantly reduced in normal rats administered the aqueous seed extract. This work justifies the use of avocado seeds in the treatment of hypertension and demonstrates its antihepatotoxic effect.

Key words: Blood pressure • Avocado • Total protein • Aminotransferases • Alkaline phosphatase

INTRODUCTION

Hypertension is one of the most important risk factors in both coronary heart disease and cerebrovascular accidents and may lead to cardiac hypertrophy with heart and renal failure. [1] In most developing or underdeveloped countries, drugs used in the management of hypertension are often imported and expensive, prompting many hypertensives to seek alternative managements which include the use of herbal preparations.

Some medicinal plants have been used in the treatment of hypertension e. g preparations of mistletoe have been reported to produce blood pressure lowering effect, [2] powdered leaves of Hibiscus rosasinensis showed blood pressure lowering effect, [3] leaf juices and pulp of avocado have been demonstrated to reduce blood pressure. [4] P. americana of the family, lauraceae, is a native fruit from Mexico and Central America. The fruit is commonly refered to as avocado pear, alligator pear or butter fruit. The plant is a tall evergreen tree that can grow up to 65 feet in height. There are dozens of varieties of avocados 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 of avocado is the Fuerte, which is larger than the Hass and has smooth dark green skin and a more defined pear shape [5].

Aqueous seed extract of P. Americana var. fuerte is used by most alternative medicine practitioners in Nigeria to treat hypertension, however adverse reactions have been reported in animals and humans on ingestion of avocado leaves, bark, skin or pit [6,7].

The aim of this work is to justify the use of aqueous seed extract of avocado in the treatment of hypertension and to determine the effect of such usage on hepatic function.

MATERIALS AND METHOD

Source of Plant Material: Fresh fruits of P. americana were purchased from Oba market, Benin City. Edo state, Nigeria.

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Preparation of Plant Extracts: The seeds were removed from the pulp, chopped into smaller pieces and dried in an oven at 40°C for 6 hours. Two kilogram of the dried seeds were pulverized and stored in a refrigerator at 4°C. 30g of the powdered seed was dissolved in 100 ml distilled water and then sieved. Dilutions were made and administered orally.

Treatment of Animals: Thirty albino rats of wistar strain were divided into six groups of 5 rats each, the animals were acclimatized for one week after which Groups I (normal control) and 6 (normal+200 mg/kg) were given growers mash only and animals in other groups were given 92% growers mash and 8% NaCl to induce hypertension. [8] 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, group 4 (hypertensive+ 500 mg/kg), 500 mg/kg b. wt aqueous seed extract, group 5(hypertensive+700 mg/kg) were given 700 mg/kg b. wt of seed extract and group 6(normal+200 mg/kg) were given 200 mg/kg b. wt seed extract for 4 weeks. The body weights of rats were measured and recorded daily. After 4 weeks, the blood pressures of rats were measured using a 2-channel recorder (Gemini,7070). The rats were anaesthetized by intraperitoneal injection of urethane, the trachea and carotid artery (either left or right) were exposed and cannulated, the arterial cannula was connected to a cardiotachographer which was in turn connected to a 2-channel recorder, which records both systolic and diastolic blood pressures [9]. The animals were dissected and blood was collected by cardiac puncture.

Biochemical Analysis: Total protein, albumin, alanine and aspartate aminotransferases and alkaline phosphatase activity were determined using assay kits (Randox Laboratories limited Crumlin, Co-Antrim Spain). Protein was determined by the Biuret method. [10] alanine and aspartate aminotransferases were determined based on the colourimetric measurement of hydrazone formed with 2, 4, dinitrophenylhydrazine [11], alkaline phosphatase by the phenolphthalein monophosphate method [12], albumin by the bromocresol green method [13].

Statistical Analysis: All data were expressed as mean±standard error of mean. Analysis of variance (ANOVA) and the least significant difference test were used to check the significant differences between various parameters at P<0.05.

RESULTS

Reduction in weight gained was observed in normal rats administered 200mg/kg drug extract. Weights gained were not significantly altered in other groups of rats compared with normal control (Table 1). Table 2 shows significant reduction in blood pressures of hypertensive rats administered the aqueous drug extract compared with the hypertensive control and a significant

<table>
<thead>
<tr>
<th>Group</th>
<th>Weight gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td>19.30±3.1</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>15.00±2.8</td>
</tr>
<tr>
<td>Hypertensive+200mg/kg</td>
<td>19.00±4.1</td>
</tr>
<tr>
<td>Hypertensive +500mg/kg</td>
<td>17.50±3.2</td>
</tr>
<tr>
<td>Hypertensive +700mg/kg</td>
<td>19.90±2.3</td>
</tr>
<tr>
<td>Normal +200mg/kg</td>
<td>2.50±3.1</td>
</tr>
</tbody>
</table>

Results are expressed as mean±S.E.M. (n=5).* significance at p< 0.05 compared with control.

<table>
<thead>
<tr>
<th>Group</th>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td>81.00±3.0</td>
<td>52.33±4.34</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>166.00±1.0*</td>
<td>128.67±6.1*</td>
</tr>
<tr>
<td>Hypertensive+200mg/kg</td>
<td>145.00±27.5*</td>
<td>76.67±11.6*</td>
</tr>
<tr>
<td>Hypertensive +500mg/kg</td>
<td>125.00±21.2*</td>
<td>66.62±2.33*</td>
</tr>
<tr>
<td>Hypertensive +700mg/kg</td>
<td>91.00±5.5*</td>
<td>56.40±4.0*</td>
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<tr>
<td>Normal +200mg/kg</td>
<td>70.00±2.1*</td>
<td>41.00±2.37 *</td>
</tr>
</tbody>
</table>

Results are expressed as mean±S.E.M. (n=5).* significance at p< 0.05 compared with control

<table>
<thead>
<tr>
<th>GROUP</th>
<th>PROTEIN</th>
<th>ALBUMIN</th>
<th>ALP</th>
<th>ALT</th>
<th>AST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Control</td>
<td>75.5±1.3</td>
<td>35.5±9.9</td>
<td>68.2±3.4</td>
<td>51.3±4.8</td>
<td>18.7±1.5</td>
</tr>
<tr>
<td>2.Hypertensive</td>
<td>39.0±8.8*</td>
<td>13.0±3.3*</td>
<td>66.9±5.9</td>
<td>60.3±7.9*</td>
<td>20.7±3.5</td>
</tr>
<tr>
<td>3.Hyp.+200mg/kg</td>
<td>74.5±8.6</td>
<td>32.5±5.5</td>
<td>65.3±1.5</td>
<td>51.7±3.8</td>
<td>15.0±4.0</td>
</tr>
<tr>
<td>4.Hyp.+500mg/kg</td>
<td>75.0±8.4</td>
<td>37.0±5.5</td>
<td>66.3±5.6</td>
<td>52.3±5.2</td>
<td>16.7±0.5</td>
</tr>
<tr>
<td>5.Hyp. +700mg/kg</td>
<td>79.5±4.5</td>
<td>37.0±5.7</td>
<td>65.7±1.0</td>
<td>55.5±7.5</td>
<td>18.0±3.5</td>
</tr>
<tr>
<td>6.Normal+200mg/kg</td>
<td>79.0±7.2</td>
<td>31.7±1.9</td>
<td>56.5±6.9*</td>
<td>51.7±4.3</td>
<td>15.7±1.9</td>
</tr>
</tbody>
</table>

Results are expressed as mean±S.E.M. (n=5)* significance at p= 0.05 compared with control
reduction in blood pressures of normal rats compared with the normal control. Total protein and albumin levels were significantly reduced in the hypertensive control rats (group II) compared with the normal control, while alanine aminotransferase’s level was significantly increased. Alkaline phosphatase activity of normal rats administered 200 mg/kg aqueous extract of the crude drug was significantly (p<0.05) reduced compared with the control, other parameters were not significantly altered. At dose levels 200 mg/kg, 500 mg/kg and 700 mg/kg body weight of extract, there were no significant (P>0.05) differences in protein, albumin, alkaline phosphatase, alanine and aspartate aminotransferases levels compared with normal control.

DISCUSSION

After 4 weeks of administering 200 mg/kg, 500 mg/kg and 700 mg/kg aqueous avocado seed extract to rats, there were significant reduction in weight gained by normal rats administered the aqueous seed extract compared with the normal control. Reduction in weight have been reported in rats fed avocado pulp [5]. Weight loss lowers blood pressure significantly in overweight individuals [14,15]. The aqueous avocado seed extract at the different doses significantly reduced blood pressures of hypertensive rats compared with the hypertensive control. Blood pressure of the normotensive rats were also significantly reduced compared with the normal control. The antihypertensive effect of avocado had been attributed to their high content of potassium [16]. Potassium is cardioprotective, adequate intake of potassium reduces the risk of cardiovascular disease like hypertension and stroke [17].

Blood pressure is the product of cardiac output and peripheral resistance [18], aqueous avocado seed extract probably decreased the heart rate which is a major determinant of the cardiac output. Salt loading had been shown to induce hypertension, [19,20] blood pressures of all the salt-loaded rats were significantly increased compared with the normal control.

Any change in the concentration of serum protein and albumin indicate a change in the normal liver functions [21], the low protein and albumin levels associated with hypertensive control rats indicate impairment in the normal function of the liver. Various pathological and physiological changes have been reported in hypertensive rats [22]. Low protein levels may occur as a result of increased protein excretion, suggesting a possible malfunction of the kidney of these hypertensive control rats, this result is in agreement with the report of some workers [23,24]. However, total protein and albumin levels of hypertensive and normotensive rats administered the aqueous seed extract were not significantly altered.

The activities of some enzymes were studied to determine the functional indices of liver, heart and skeletal muscles; the enzymatic activity of alanine (ALT) and aspartate (AST) aminotransferases and alkaline phosphatase were studied to evaluate liver malfunctions. AST is found nearly in every tissue of the body, serum AST concentrations increase shortly after myocardial infarction and hepatic parenchyma injury [25].

AST levels were not significantly altered in both hypertensive and normotensive rats administered the aqueous drug extract compared with the normal control. ALT is an enzyme found mostly in the liver, smaller amounts are found in the kidney, heart and muscle [25]. Under normal conditions, ALT levels in the blood is low, however, when the liver is damaged, ALT is released into the bloodstream before more obvious symptoms of liver damage occur [25].

Increased ALT levels were only associated with hypertensive rats that were not given the aqueous seed extract. ALT levels were not significantly affected in both normotensive and hypertensive rats that were administered the aqueous seed extract. Alkaline phosphatase (ALP) tests is usually required if a patient has symptoms of liver or bone disorder. It is often very high during growth and developmental stages. Reduction in ALP activity associated with normotensive rats may be due to reduction in weight gained by the normotensive rats compared with normal control.

CONCLUSION

Although P.americana seeds have been used traditionally in the treatment of hypertension, the leaves, bark, skin and seed have been reported to elicit toxic effects on animals and allergic reactions in humans. This work has therefore justified the use of the seed of this plant in the treatment of hypertension and has also demonstrated its antihepatotoxic effect at the different doses of administration.
REFERENCES


