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Effects of Aqueous Extract of Extra – Cotyledonous Deposit of Pride of Barbados (*Caesalpina pulcherrima*) on Some Blood Electrolytes and Urea Levels in Rabbits

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Abstract: Study was conducted on the effects of aqueous extract of extra-cotyledonous deposit of Pride of Barbados (*Caesalpina pulcherrima*) on some blood electrolytes and urea levels in rabbits. Rabbits used were of New Zealand strain and weighed between 1750 and 1900g. About 200ml of the aqueous extract were administered daily to the test rabbits orally through clean drinking troughs for a period of 28 days. Blood was obtained from rabbits intravenously through the larger veins at the back of the ear. Results obtained, showed that the values of Na^+, K^+, Cl^-, $HC0_3^-$, Mg^{2+}, Ca^{2+}, Phosphorus and urea for control and test ranged from 133-140 and 134-141 mmol/l; 3.8-4.5 and 3.7-5.0 mmol/l; 101-107 and 99-107 mmol/l; 21-27 and 22-28 mmol/l; 4.0-5.2 and 4.9-5.2 mmol/l; 6.5-7.0 and 6.2-7.2 mmol/l; 4.9-6.0 and 5.1-6.1 mg/100ml; 27-35 and 27-34 mg/dl respectively. The above values are within the normal ranges. The aqueous extract of extra-cotyledonous deposit of Pride of Barbados (*Caesalpina pulcherrima*) may therefore contain agents capable of stabilizing normal electrolyte balance in the blood.

Key words: Aqueous extract, extra - cotyledon, pride of barbados, blood electrolytes , urea

Introduction

Pride of Barbados (*Caesalpina pulcherrima*) is one of the common names of a small evergreen perennial shrub. It is a leguminous plant belonging to the leguminosae family, which is the second largest family among dicotyledons. Other common names of this plant include the following: dwarf poinciana, red bird of paradise (the red variety), yellow bird of paradise (the yellow variety), krere-krere, tabachin, tabaquin, barbados flower-fence and peacock flower (Burton, 1985; greendealer-exoticseeds.com/seeds/pride of Barbados = 2001). This shrub originates from the tropical West Indies and has alternate, bipinnately divided leaves. The family is made up of approximately 650 genera and 1800 species, divided into three sub-families; caesalpinieae, mimoseae and papilionaceae. Its species are found in temperate, humid tropics arid highland, savanna and lowland zones (Dutta, 1981). The flowers of Pride of Barbados (*Caesalpina pulcherrima*) are in terminal clusters; 5-parted, yellow or yellow-orange with long exerted, red stamen. This plant flowers throughout the year and is usually 10 to 15 feet high.

As a legume, it has pods that split into two parts to release dry and brown mature seeds. The cotyledon constitutes the major food storage organ of the seed as in cowpeas, and groundnut (Onwueme, 1979). The seeds are laterally arraigned in pods. The mature fresh (green) seed is covered by a green testa under which is the translucent coat over the cotyledon known as the extra-cotyledonous deposit. This deposit is the only edible part of Pride of Barbados, which is usually consumed fresh and casually by children and sometimes, adults in some parts of Nigeria. Nutritional and anti-nutritional studies on extra-cotyledonous deposit have shown that it is not poisonous and could be tolerated as an additional nutritional supplement (Prohp and Alaiya, 2003; Prohp *et al*., 2004; Prohp and Maduemezia, 2004, Prohp *et al*., 2006).

The objective of this study, therefore, is to provide information on the possible effects of aqueous extract of extra-cotyledonous deposit of Pride of Barbados grown in Nigeria on some blood electrolytes and urea levels in rabbits because of the roles of these parameters in central metabolism and in the maintenance of blood acid – base balance.

Materials and Methods

Animals: Rabbits (males and females) of the New Zealand strain were used. They weighed between 1750 and 1900g and were fed on growers mash. These animals were maintained under standard animal house conditions and allowed free access to food and water.

Chemicals: Blood urea nitrogen acid (BUN acid), diacetyl monoxime (colour reagent), hydrochloric acid, mercuric nitrate, diphenyl carbazone, phenol red solution (pH 7.4), sodium hydroxide and chloroform were of Analar grade. All reagents were purchased from standard suppliers.

Preparation and Administration of Extra-Cotyledonous Deposit: The pods were dissected aseptically to unveil

Table 1: Electrolytes and Urea levels in normal rabbits administered aqueous extract of extra – cotyledonous deposit of Pride of Barbados (*Caesalpina pulcherrima*).

Day		Na^+ l mmole/	K^+ mmole/l	Cl^- mmole/l	HCO_3^- mmole/l	Mg^{2+} mg/100ml	Ca^{2+} mmole/l	P mg/100ml	Urea mg/dl
0	C	135.00±2.46	4.90±2.00	107.00±2.72	24.00±1.27	4.20±1.00	7.00±0.12	5.08±0.10	30.00±0.70
	T	137.00±2.60	5.00±1.91	104.00±2.10	24.00±2.21	5.20±1.00	6.42±0.21	5.77±0.14	31.00±0.01
1	C	137.00±2.28	4.00±2.14	101.00±1.10	24.00±1.84	4.40±1.10	6.70±0.12	4.97±0.11	28.00±1.23
	T	138.00±2.40	4.90±1.74	103.00±2.46	24.00±1.42	5.00±0.90	7.24±0.24	5.42±2.00	34.00±1.21
6	C	134.00±2.42	3.98±2.21	103.46±2.10	23.23±1.75	5.06±1.13	7.14±0.10	5.28±0.09	29.33±1.84
	T	134.00±2.41	4.86±2.24	99.34±2.26	26.24±2.31	4.93±0.11	7.07±0.18	6.01±1.70	28.97±2.00
12	C	137.21±2.40	3.81±2.41	104.37±1.70	27.62±2.10	4.08±1.24	6.29±0.14	5.45±0.07	35.29±2.01
	T	141.71±2.00	4.02±2.18	106.48±2.41	22.10±2.62	4.99± 0.86	6.27± 0.19	6.13±0.11	27.00±2.11
18	C	133.07±2.20	4.14±1.00	104.46±1.10	21.48±3.10	4.96±1.31	6.57±0.20	5.23±0.11	31.34±1.92
	T	141.55±2.10	3.76±.97	107.78±4.01	24.99±2.41	5.13±.44	6.29±0.11	5.11±0.11	30.44±2.11
24	C	135.44±2.41	4.25±1.02	107.19±1.41	23.76±4.00	4.87±1.04	6.53±0.14	5.14±0.04	32.45±1.89
	T	139.32±2.27	3.97±2.47	103.02±2.19	28.59±2.22	4.83±1.26	6.25±0.12	5.51±0.20	31.22±1.18
28	C	140.77±2.65	4.52±2.01	104.46±1.10	24.49±2.81	5.26±1.18	6.91±0.17	6.01±0.10	27.24±2.02
	T	139.68±2.48	4.21±2.32	106.11±2.41	23.99±1.78	4.91±0.98	6.42±0.10	5.81±0.40	32.97±1.40

C = Control; T = Test. Values are mean ± S. E. M of three separate determinations from six rabbits.

green seeds laterally positioned on either side of the opened pods. The green testa over the seed was carefully removed using sterile forceps and razor blade to avoid any microbial contamination. The translucent coat over the cotyledon was then separated as the extra-cotyledonous deposit and kept in clean transparent cellophane before preserving in the refrigerator at -21°C until analyzed (Enweani *et al.*, 2005). Extra-cotyledons of Pride of Barbados were macerated and ground (1g/10ml) using distilled water. Crude extract was centrifuged at 500rpm for 5 minutes to obtain slightly turbid supernatant. About 200ml of the supernatant were administered to each rabbit orally through the drinking trough daily. Excess extracts were stored in clean drinking jerries at -21°C until required. Control and test rabbits (3 each) were allowed free access to distilled water and the extract respectively for the desired period of experiment. Troughs depleted of distilled water and extract were immediately replenished.

Blood collection and electrolyte analysis: Blood was obtained intravenously from the ear lobes of the rabbits and electrolyte analysis conducted. Plasma urea was analyzed by the method of Tietz, 1996a, chloride by Schales and Schales, 1941 and bicarbonates by Tietz, 1996b method. Flame photometry was used in the analysis of sodium and potassium.

Results

The results have been presented in Table 1. Statistical analysis by the student t-test showed that the aqueous extract of extra-cotyledonous deposit of Pride of Barbados (*Caesalpina pulcherrima*) do not have any significant effect on the blood electrolytes and urea levels ($P>0.05$) when compared with the control.

Discussion

Pride of Barbados (*Caesalpina pulcherrima*) is the second largest family among dicotyledons (Onwueme, 1979). In some parts of the world, leaves of this legume are used as purgatives and also, serve as cure for kidney stones, malaria fever and bronchitis. The roots and stems are cytotoxic. Electrolytes, as essential component of all living matter, play very important roles in the body. Some of these roles include maintenance of osmotic pressure and hydration of the various body fluid compartments, maintenance of the body pH, thereby, influencing the acidity or alkalinity of the blood stream (Morton and Charles, 1980), regulation of the proper functioning of the heart and other muscles and participation as an essential part of some enzymes. Almost all metabolic processes are dependent on electrolytes (Levinsky, 1995).

Electrolyte disturbances could occur with malfunctioning of the kidney (renal failure), infections that produce severe and continual diarrhea or vomiting, drugs that cause loss of electrolytes in the urine (diuretics) or diseases that involve hormones that regulate electrolyte concentration in the blood (Klahr, 1996).

Sodium plays a central role in the maintenance of normal distribution of water and osmotic pressure in the various fluid compartments having a normal dietary intake of approximately 130 to 260 mmole. This is nearly completely absorbed from the gastro-intestinal tract while the excess is excreted by the kidneys (Devine *et al.*, 1999). Monica (1987) reports the approximate reference (normal) ranges of some of these electrolytes as 134-146, 3.5-5.5, 98-108, 21-30 mmol/l and 15-45 mg/dl for Na^+, K^+, Cl^-, HCO_3^- and urea respectively.

The levels of electrolyte obtained in this study are within the normal ranges. It could therefore not be completely out of place to submit that the aqueous extract of extra-cotyledonous deposit of Pride of Barbados might be helpful for proper maintenance of electrolyte balance in the blood. Proper maintenance of blood electrolytes and urea would rule

out the occurrence of some diseased conditions associated with electrolyte imbalance, example of which include hyponatremia / hypernatremia; hypokalaemia / hyperkalaemia, hypochloremia / hyperchloremia;

alkalosis / acidosis, hypomagnesia linked to low Ca^{2+} level, low K^{+}, diabetes and dialysis (Ganong, 1987), azotemia diseases or damage of the kidneys (Adroge and Madias, 2000; Morton and Charles, 1980; Cohn *et al.*, 2000; Sheng, 2000; Nakamura *et al.*, 1999). Reports by Nakamura *et al.*, 1999 showed that Cranberry leaves increased the bicarbonate, HCO_3^- and urea levels in the blood.

Since the kidneys excrete some electrolytes, it is also, important to observe that in proper maintenance of electrolyte balance, the kidneys must be in good condition. This aqueous extract may not therefore, contain agents, chemical or otherwise, capable of interfering with the proper functioning of the kidneys. Further analyses are continuing in this area for the purpose of adding substantially to knowledge and/or possibly unraveling a cure for one or more endemic diseases.

Extra-cotyledonous deposit of Pride of Barbados is not toxic and its aqueous extract may be very useful in stabilizing electrolyte balance in the blood.

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