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Effect of ethanol stem bark extract of *Piptadeniastrum africanum* (Hook.f.) on serum electrolytes balance of albino rats

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Abstract

The aim of this study was to determine the effect of *Piptadeniastrum africanum* stem bark extract (PASBE) on serum electrolytes of albino rats. Freshly harvested stem bark of *P. africanum* was dried at room temperature and afterwards ground into fine powder which was subsequently extracted. Twenty five (25) adult male albino rats were divided into five groups of five rats each. **Group I** was the normal control, **Group II** was administered 500 mg/kg of extract, **Group III** was administered with 1000 mg/kg of extract, and **Group IV** was administered 2000 mg/kg of extract while **Group V** was administered 2500 mg/kg of extract. Treatment lasted for 28 days after which animals were sacrificed and blood sample collected and analysed by standard procedures. There was no significant (P>0.05) difference in the levels of serum electrolyte across the various groups compared to the control. In conclusion, the amount of serum electrolyte balance was not disturbed following the administration of extract.

Keywords: *Piptadeniastrum africanum*; Electrolytes; Serum; Extract; Stem; Bark

1. Introduction

Physiologically, electrically charged molecules are considered electrolytes. They are known for critical functions such as controlling of blood clotting, acid base balance, and body fluid as well as muscle contractions. The human body is an embodiment of several electrolytes each designated for a specific task. However, most are involved with the maintenance of balance between the intracellular and extracellular compartments and may considered essential to hydration, nerve impulses, muscle functions and pH level [1]. Fundamentally, potassium, sodium, magnesium, calcium and chloride as well as calcium, phosphate and bicarbonates are the major electrolytes [1]. Thus, any derangement from normal range of electrolyte levels in the body is indicative of certain metabolic and physiological abnormalities [2]. Therefore, serum electrolyte concentrations are the most common tests which can be used to assess a patient's clinical condition.

Electrolyte disorders known to be caused by the unavailability of minerals for absorption by the gastrointestinal tract or impaired ability of the gastrointestinal tract to absorb mineral elements effectively among other factors are wide spread among diverse categories of patients and have been implicated increased morbidity and mortality. The toxic components in plants have been implicated as a major factor that impairs the absorption of minerals by the GIT. For instance, the ability of phytate to chelates several minerals wields the potential to translate to unavailability of affected minerals to absorption which may hitherto predispose an individual to electrolyte disorder [1].

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An estimated 80 % of the population of developing countries relies extensively on plant based therapies primarily due to their availability as well as affordability [3]. Although plants have been involved effectively in the treatment of diverse human ailments, the fact that it wields the potential to inflict injury cannot be set aside, this is evident by the fact that some plants could be considered very rich in factors that can interfere and adversely affect the functionalities of cells, tissues or organs [4].

Piptadeniastrum africanum (Hook.f.) is a large tree which measures up to 50 m high. Timber obtained from the said tree is called Dabema or Dahoma. *P. africanum* is found throughout the West Africa tropical rainforests of countries such as Nigeria, Cameroon, Senegal among others [5]where is its stem bark has been extensively employed in the treatment of diverse arrays of diseases such as tuberculosis, HIV/AIDS, abdominal pain, fever, and cough [6]; [7]. Previous research efforts by Ebu et al [8] had reported the presence of phytic acid in a number of herbs including *Piptadeniastrum Africana*. However, there is paucity of data as to whether or not the amount of the aforementioned compound can induce electrolyte disorder.

2. Material and methods

2.1. Collection of plant material

Freshly harvested stem bark of *Piptadeniastrum Africana* was subsequently identified at the Department of Forestry, Michael Okpara University of Agriculture Umudike, Abia State Nigeria. After which it was chopped into pieces before being dried at room temperature for 6 days. Dried leaves were ground into fine powder with the aid of an electric grinding machine. 500 g of the powdered plant sample was steeped in 1 litre of 100% ethanol for 72 h and the resulting extract was filtered using Whatman no. 1 filter paper and lastly concentrated using rotary evaporator.

2.2. Animals

Adult male wistar were procured from the animal house of the Department of Science Laboratory Technology, Akanu Ibiam Federal Polytechnic Uwana Afikpo. The rats were housed in adequately ventilated cages under standard laboratory conditions and were maintained at ambient temperature and relative humidity respectively. They were fed rat chow and allowed access to water *ad libitum*. Acclimatization of rats lasted for two weeks after which experiment commenced.

2.3. Acute Oral Toxicity Study

Acute oral toxicity was determined in accordance with the method of Organization for Economic Cooperation and Development (OECD 425, 2008) using limit test dose of 2 g/kg. Five apparently healthy adult male wistar rats which had been denied food for 4 h were dosed. The first animal was administered a limit dose of 2000 mg/kg and no death was observed within 24 h of after. Another four mice were dosed and observed for signs of toxicity such as diarrhea; weight loss and absence of tremor, lethargy, and paralysis periodically for the first four hours during the 24-h period and later were followed for 14 days for any lethality [9]OECD, 2020).

2.4. Animal Grouping

Twenty five rats divided into five groups of five rats each were treated as follows

- **Group 1**: Rats were only fed rat chow
- **Group 2:** Rats were administered 500 mg/kg bw of *P africana* stem bark extract.
- **Group 3**: Rats were administered 1000 mg/kg .bw of *P africana stem bark* extract.
- Group 4: Rats were administered 2000 mg/kg .bw of *P africana stem bark* extract.
- **Group 5**: Rats were administered 2500 mg/kg bw of Sodium valproate

Administration of extracted lasted for Twenty eight (28) days, after which animals were humanely sacrificed and blood was collected into EDTA bottles and were subsequently centrifuged at 3000 rpm for 10minutes.

2.5. Determination of blood electrolyte

Serum electrolytes (Na^+, Cl^-, K^+& Ca^+) were determined thus; Chloride was evaluated by the mercury chloride colorimetric method and total calcium by the orthocresolphthalein method. Sodium and potassium was measured by the flame photometric method (Flame Photometer).

2.6. Statistical analysis

Data generated from the study was analyzed using statistics software IBM SPSS Statistics 21. Data were expressed as mean ± standard deviation (SD). The results were considered as significant at $P<0.05$. Mean values were compared using one way analysis of variance (ANOVA).

3. Results

Table 1 Serum Electrolytes of Rats administered with Ethanol Stem Bark Extract of Piptadeniastrum Africana

Group	Treatment	Na+	Cl-	K+	HCO3+
Group I	Normal control	149.00±2.00^{b}	103.00±1.00^{a}	6.95±0.05^{b}	21.00±0.00^{a}
Group II	500 mg/kg PASBE	147.70±1.60^{ab}	104.10±2.80^{ab}	6.78±0.30^{ab}	20.00±0.50^{a}
Group III	1000 mg/kg PASBE	149.00±0.00^{b}	103.00±1.00^{a}	7.75±0.25^{bc}	20.00±0.70^{a}
Group IV	2000 mg/kg PASBE	149.00±4.00^{b}	106.00±1.00^{b}	7.79±0.80^{bc}	21.00±1.00^{ab}
Group V	2500 mg/kg PASBE	149.00±4.60^{b}	108.50±0.50^{bc}	6.70±0.50^{b}	22.00±0.60^{ab}

Results are expressed as mean ± standard deviation of three determinations. Values with different superscript in a column are significantly different at ($P\leq0.05$).Note: SBEPA: *Piptadeniastrum africanum* Stem Bark Extract (PASBE)

4. Discussion

The pertinence of the essentiality of electrolytes to the wellbeing of an individual cannot be denied. This is evident by the fact that they are critically involved in the maintenance of electrical neutrality in cells, generation and conduction of action potentials in the nerves and muscles. Measurement of serum electrolyte concentrations is the most commonly used approach for evaluating a patient's clinical condition and disorders associated with electrolyte imbalance have been implicated in increased morbidity and mortality. Table 1 shows the serum electrolytes of rats administered ethanol stem bark of *P. africanum* indicating that there was no significant ($P<0.05$) difference in serum electrolyte levels across all treatments compared to the value recorded on the normal control. This could be attributed to the reportedly safe level of phytate in the stem bark of *P. africanum* [8].

5. Conclusion

Through this study, it has been deduced that ethanol stem bark extract of *P. africanum* does not distort the serum electrolyte balance. This implies a safe level of a chelating agent such as phytic acid in the stem bark of the said tree.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors declare that no conflict of interest exists.

Statement of ethical approval

Ethical approval was issued by the University's Committee on the care and handling of laboratory animals.

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