International Journal of Herbs and Pharmacological Research
IJHPR, 2017, 6(2): 31- 37
ISSN: 2315-537X www.arpjournals.com; www.antrescentpub.com E- ISSN: 2384-6836

RESEARCH PAPER

EFFECT OF SIDA CORYMBOSA LEAF EXTRACT ON THE ELECTROLYTE AND BLOOD GLUCOSE LEVEL OF ALLOXAN-INDUCED DIABETIC ALBINO WISTAR RATS.

*** Ezeugwunne, I.P.[2,3], Ebezue, C.U.[1], Ogbodo, E.C.[2], Analike, R.A.[4], Ezego, W.A.[1], Onah, C.E.[4,5], Madukwe, D.U.P.[2], Okwara, J.E.[2,5], Amah, U.K.[5], Oguaka, V.N.[3], Oha, P.C.[2], Asebioyo, S.J.[6].**

[1]Department of Environmental Health Science, Nnamdi Azikiwe University, Nnewi Campus; [2]Department of Medical Laboratory Science, Faculty of Health Sciences, NnamdiAzikiwe University, Nnewi Campus; [3]Department of Human Biochemistry, Faculty of Basic Medical Sciences, NnamdiAzikiwe University, Nnewi Campus; [4]Department of Chemical Pathology, NnamdiAzikiwe University Teaching Hospital, Nnewi; [4]Department of Chemical Pathology, Faculty of Medicine, Nnamdi Azikiwe University, Nnewi Campus; [5]Department of Human Anatomy, Faculty of Basic Medical Sciences, Nnamdi Azikiwe University, Nnewi Campus.
*Corresponding Author: Dr. I.P. Ezeugwunne
Email: goodnessifeoma007@yahoo.com

Published: 30th April, 2017

Endorsed By: *Innovative Science Research Foundation (**ISREF**) and International Society of Science Researchers (**ISSCIR**).* ***IndexedBy****: African Journal Online (AJOL); Texila American University; Genamics; Scholarsteer; EIJASR; CAS-American Chemical Society; and IRMS Informatics India (J-Gate)*

ABSTRACT

This study was designed to investigate the effect of *Sida corymbosa* (SC) leaf extract on plasma potassium (K^+), Sodium (Na^+), Chloride (Cl^-), Bicarbonate (HCO_3^-) and blood sugar in alloxan induced diabetic albino wistar rats. A total of 30 albino wistar rats each weighing 100g were assembled and divided into 3 groups (A-C; n =10 each). Group A received SC treatment; B was without SC treatment; while C served as control. Aqueous extract of SC leaf (0.05mg/kg) was administered orally to the rats in group A but not in group B while group C received only water for 7 days. Blood samples were collected into fluoride oxalate and lithium heparin containers for estimation of glucose and other biochemical parameters respectively. Plasma glucose, Na^+, K^+, Cl^-, and $HCO3^-$ were analyzed using standard methods. There was a significant decrease in the mean plasma glucose (100.60±0.84Vs193.70±0.84; p=0.000) and Na^+(139.10±2.23 Vs 140.20±1.23; p=0.003) levels in post SC treatment when compared to pre-treatment levels, but asignificant increase in the mean plasma K^+ (7.70±1.64 Vs 7.48±1.98; P=0.000) levels. Again, there was a significant decrease in mean weight of subject after SC administration (100.00±0.52 vs 119.40 ± 1.17; p=0.000).No significant difference was recorded between the pre and post–SC levels of Cl^- and HCO_3^- suggesting overall that SC has hypoglycaemic, antihypertensive andanti-obesitypotentials.

Keywords: *Sida corymbosa,* glucose, sodium, potassium, Chloride, Bicarbonate.

INTRODUCTION

The use of plants as source of remedies for the treatment of diseases can be traced back to the prehistoric times (Lawrence and Bennett, 1995; Evans, 2009; Ankita *et al.,* 2012) and medicinal herbs are being increasingly studied by pharmacological researchers (Sinclair, 1998). Indian Ayurveda medicine used herbs as early as 1900BC describing about 700 medicinal plants (Aggarwal *et al.,* 2007; Caceres *et al.,* 2007). According to the World Health Organization more than 80% of the world's populations rely on traditional medicine for their primary health care majority of which use plants or their active ingredients Gupta *et al.,* 2005; Chopra *et al.,* 2013).

Medicinal plants play a key role in human health care and the use of plant resources for herbal medicine and other purposes in Nigerian pre-dates medical history. The medicinal value of these plants depend essentially on its phyto-chemical composition. These phyto-chemicals are the biochemical elements responsible for the definite physiological effects rendered on the human body. *Sida* is one of ethnomedicinally important genus of plants which belongs to the family called malvaceae (Ajithabai *et al.,* 2012). *Sida* plants have over 200 species which are used in treatment of diseases (Narasinha *et al.,* 2013). It is found growing in most parts of Nigeria as common weeds. In the South Eastern part of Nigeria, it is called "Udontike", "Udonwatakaike", "Udoike" and "Acharaike" (Lucy *et al.,* 2014).

MATERIALS AND METHODS

Study Location: The study was carried out at The Human Biochemistry Laboratory, Nnamdi Azikiwe University. It is located in the suburb of Nnewi - a popular town in Anambra State Nigeria.

Collection and identification of plant: The *Sida corymbosa* plant was collected from Okofia College of Health Sciences and Technology, Nnamdi Azikiwe University Nnewi campus, Anambra state Nigeria in the month of January, 2016 and identified by Mrs. Aziagba B.O., Department of Botany, Nnamdi Azikiwe University, Akwa.

Animals: Wistar albino rats (100g) of both male and female were obtained from the Institute Animal House and maintained at 25±2 ºC temperature and relative humidity 45-55% under 12:12 h light:dark cycle. Rats were fed with standard rat chow and water ad-libitum.

Preparation of the plant extract: The method used is based on the method described by kalita *et al;* (2013), although with some modification. About 150 g of dried leaves of *Sida corymbosa* were taken in a 1000 mL of the round bottom flask and extracted for 72 h by a continuous hot percolation process using the solvent ethanol as solvent. The extracts were filtered through the Whatmann filter paper to remove impurities. The extracts were then concentrated by vacuum distillation, cooled and placed in desiccators to remove the excessive moisture.

Alloxan induced hyperglycemia: Animals were divided into three groups, each consisting of ten rats. Rats in the first group(A) received 0.05mg/kg *Sida corymbosa* dissolved in ethanol while the second group of rats (B) received ethanol. Rats in groups 3 were normal rats and served as the control groups (C). All the animals received their respective assigned treatment daily for a period of seven days. Rats were daily fasted over night before *Sida corymbosa* treatment. On day 8, the animals were anesthetized with ether, and blood was collected using cardiac puncture. Serum was then separated for the estimation of glucose and electrolytes (Na^+, K^+, Cl^-, and HCO_3^-) by using standard methods as described by Bergmeyer and Bernt (1974) while electrolytes were estimated using ion selective electrode (ISE).

Ethical Consideration: The protocol was approved by the Faculty of Health Sciences and Technology ethical committee, Nnamdi Azikiwe University, Nnewi campus, Anambra State, Nigeria.

Inclusion and Exclusion criteria: Apparently healthy Wistar rats weighing 100-120g were included for the study while Unhealthy Wistar rats with weight less or above 100g were excluded from the study in order to ensure accuracy and uniformity in result interpretation.

Statistics: Statistical package for social science (SPSS) version 20 was employed in the analysis of the result. The results for the parameters studied were expressed as Mean± SD and the data were analyzed using one-way ANOVA and compared between the groups using student paired t-test and Pearson correlation r. Level of significance was set at $p<0.05$.

RESULTS

In this study, the serum levels of Na^+, K^+ and FBS were significantly decreased in Alloxan induced diabetic rat with *Sida* treatment than those without *Sida* treatment and control group at $P<0.05$ respectively while serum levels of Cl^- and $HCO3^-$ were statistically insignificant when compared among the groups using ANOVA table (Table 1 and figure

2).Again, there was a significant decrease in mean weight of the subjects treated with *Sida corymbosa* when compared with those without *Sida* treatment (Figure 1).

Table 1: Serum Levels Of FBS and Electrolyte Profile in Alloxan Induced Diabetic Rat with *Sida* Treatment (A), Without *Sida* Treatment (B) And Control Group (C) (Mean ± SD; N=10; P<0.05).

Group	Na^+ (mmol/l)	K^+ (mmol/l)	Cl^- (mmol/l)	$HCO3^-$ (mmol/l)	FBS (Mg/dl)	Weight (g)
A (n=10)	139.10±2.23	7.70±1.64	99.50±1.65	15.50±1.65	100.60±0.84	100.00±0.52
B(n=10)	140.20 ± 1.23	7.48 ± 1.98	103.40 ± 1.07	16.20 ± 3.21	193.70 ± 0.84	119.40 ± 1.17
C(n=10)	135.30 ± 4.50	3.94 ± 0.33	99.70 ± 7.67	16.20 ± 0.92	100.10 ± 2.64	100.60 ± 0.84
F(P)-value	7.418 (0.003)	19.905 (0.000)	1.890 (0.171)	0.571 (0.572)	29.774 (0.000)	150.000 (0.000)

Keys -F (P)-value = mean ± SD of parameters compared among groups A, B and C using ANOVA

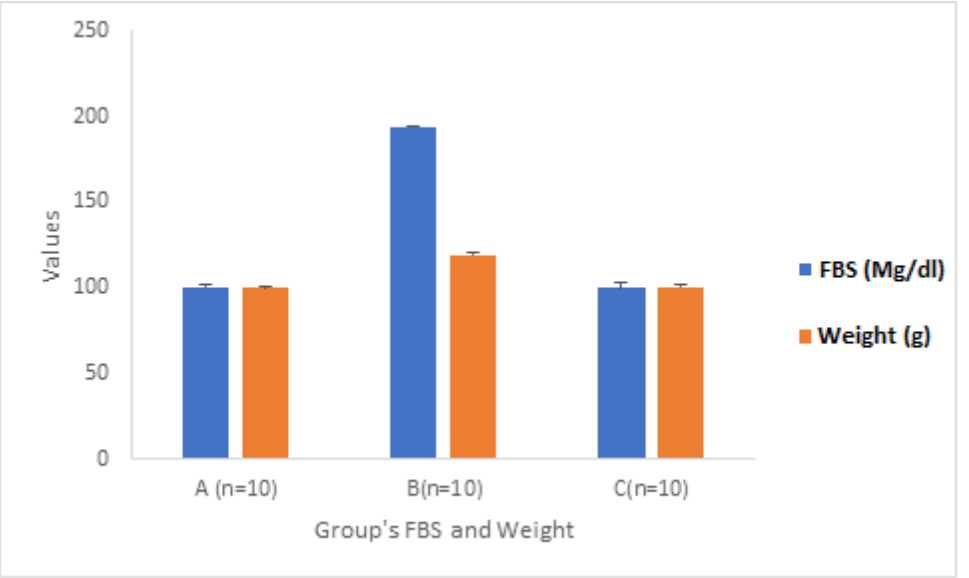

Fig. 1: A bar chart of showing the Fasting Blood Sugar and mean Weights of the experimental groups studied

The serum levels of Na^+ and K^+ were statistically significant when the Alloxan induced diabetic rat with *Sida* treatment and control group were compared using paired t-test but the serum levels of Cl^-, $HCO3^-$ and FBS were statistically insignificant when compared using paired t- test (figure 1).

When the Alloxan induced diabetic rats without treatment were compared with the control group, the serum levels of Na^+, Cl^- and $HCO3^-$ showed a significantly different at P<0.05 but K^+, and FBS were statistically insignificant at P>0.05(figure 1)

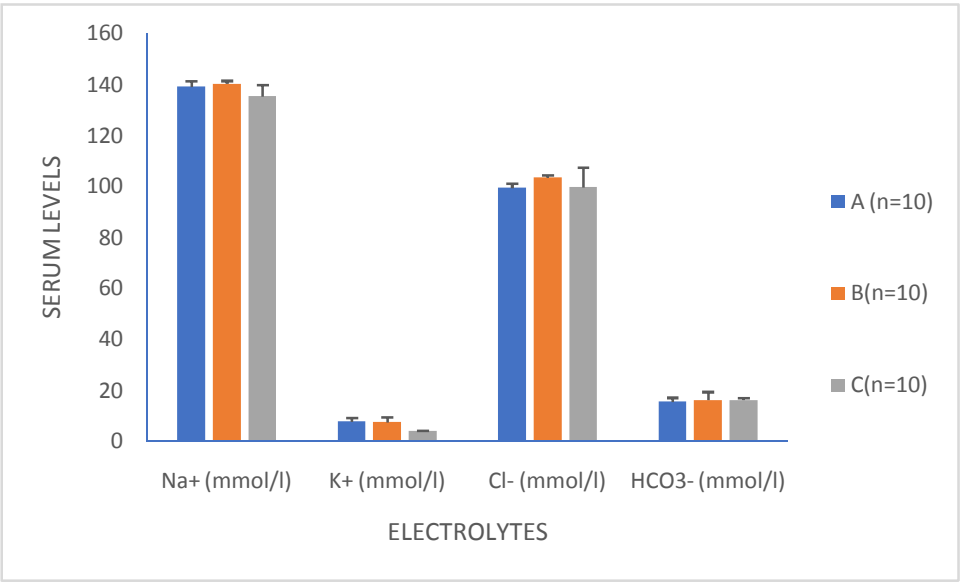

Fig. 2 A bar chart showing the Serum electrolytes of the experimental groups studied

There was a positive correlation between serum levels of K and $HCO3^-$ when Alloxan Induced Diabetic Rats without Treatment was correlated with the control group (Table 2).

Table 2: *Sida corymbosa* correlation control Level of association between Electrolyte profile and FBS studies in Alloxan Induced Diabetic Rats without Treatment.

Parameters	Pearson r correlation	P- value
K v $HC0_3$	.846	.002

***Statistically significant at P<0.05**

There was a positive correlation between serum levels of K and Cl^- as well as $HCO3^-$ and FBS when Alloxan Induced Diabetic Rats with Treatment and control group (Table 3).

Table 3: *Sida corymbosa* correlation control Level of association between Electrolyte profile and FBS studies in Alloxan Induced Diabetic Rats with Treatment.

Parameters	Reason correlation	P-value
K v Cl^-	.961	.000
HCO_3^- v FBS	.782	.007

***Statistically significant at P<0.05**

DISCUSSION:

The *corymbosa* plant family has been found to be a potential and promising plant for medicinal purposes such as diabetes, hyperlipidemia and hypertension in Ayurvedic medicine (Pole and Sebastian, 2006; Radhika *et al*., 2013).

In this study, *S. corymbosa*administration significantly reduced the plasma glucose concentration in the Alloxan induced diabetic rat with *sida* treatment. This result confirms the report of Radhika *et al*., (2013) who investigated the antihyperglycemic potential of *Premna corymbosa* in rats and found that the plant was effective in reducing the glucose level and controlling the loss of body weight in diabetic rats. Other similar studies in rats also did show the reducing effect of *S. corymbosa* on blood glucose level (Bennet and Joslin, 1998; Dash *et al.,* 2005; Pole and Sebastian, 2006).

The decreased level of fasting blood sugar in the alloxan induced diabetic rats with *Sida* treatment maybe as a result of its stimulation of insulin release from the pancreatic-beta-cells or its release from the bound form (Davis *et al.,* 2002; Nolte *et al.,* 2004; Banshidhar and Deepmala, 2013). Furthermore, there may have been stimulation of peripheral glucose utilization or enhancing glycolytic and glycogenic processes with concomitant decrease in glycogenolysis and gluconeogenesis (Andrade-cetto and Wiedenfeld, 2004). In addition, the antihyperglycemic activity of *S. corymbosa* may also be due to the presence of hypoglycemic saponins, alkaloid and steroids (Pole and Sebastian, 2006; Okwu and Josiah, 2006; Sparg, 2004; Sahu *et al.,* 2008).

The present study shows a significant reduction in the mean serum level of sodium following the treatment of the alloxan induced diabetic rats in contrast to the mean plasma level of potassium. The mean plasma potassium level was significantly increased after the alloxan induced diabetic rats were subjected to treatment. This decrease in serum level of sodium may be as a result of the body's homeostatic mechanism to maintain a stable equilibrium or balance between the extracellular sodium and intracellular potassium (Clapp *et al.,* 2009). The potassium helps regulate the amount of sodium in the blood, thus helping to keep the sodium level low and thereby lowering the risk of developing high blood pressure and other cardiovascular complications (Clapp *et al.,* 2009). The mean plasma level of bicarbonate and chloride remained the same at the end of the treatment of the alloxan induced diabetic rats. There was a positive correlation between serum levels of K and $HCO3^-$ when Alloxan Induced Diabetic Rats without Treatment was correlated with the control group.

There was a positive correlation between serum levels of K and Cl^- as well as $HCO3^-$ and FBS when Alloxan Induced Diabetic Rats with Treatment and control group.

Conclusion

From the current study, we conclude that *S. corymbosa* has significant antihyperglycemic and antihypertensive effects. Therefore, *S. corymbosa* can be useful, at least as an adjunct, in the therapy of diabetes, a condition in which hyperglycemia and hyperlipidemia coexist quite often as well as in the management of hypertension.

However, further study is necessary for the screening of chemical compounds and the structure elucidation of the respective antidiabetic and antihypertensive property as well as their extraction mechanism.

Recommendation

Based on our findings, we recommend that*S. corymbosa* can be used in the management of Diabetes Mellitus as well as hypertension. However, further studies should be carried out to fully understand the full benefit of *S. corymbosa.*

ACKNOWLEDGEMENT
Our unreserved gratitude goes to all those who contributed to the success of this research and presentation of this Manuscript. Worthwhile to mention is my parents, Mr. and Mrs. Ebezue who contributed immensely (both morally and financially) to the completion of this research work. The encouragement and guidance provided to me in the course of this work by Dr. I.P. Ezeugwunne is highly appreciated. Also, I must not fail to acknowledge the assistance provided me by Mr. E.C. Ogbodo, Mr. C.C. Dike and Mr. C.E. Onah during this work. Thank you so much. May God bless you all abundantly.

REFERENCES

Aggarwal, B.B., Sundaram, C., Malani, N. and Ichikawa, H. (2007). Curcumin, the Indian Solid Gold. *Journal of Advanced Experimental Medical Biology,*595:1-75.

Ajithabai, M.D., Sunitha Rani, Balachandran, S., Jayakumar, G. (2012). Review on the species of Sida used for the preparation of Nayapayan kashayam. *International Journal of Research Pharmacy and Applied Science;* 2:173-195.

Alebiosu, C.O., Ugwa, O.M., Ugwa Oguejiofor, C.J., Njan, A.A. (2012).Botanical studies of medicinal plants used in the management of peptic ulcer disease in Sokoto state, North Western Nigeria. *International Research Journal of Pharmacy;*2(9):225-230.

Andrade-Cetto, A. and Wiedenfeld, H. (2004). *Journal of Ethnopharmacology;*90: 217. http://dx.doi.org/10.1016/j.jep.2003.09.049

Ankita, S., Kaur, P., Gupta,R. (2012).Phytochemical screening and antimicrobial assay of various seeds extracts of Cucurbitaceae Family.*International Journal of Applied Biology and Pharmaceutical Technology;*3 (3) 401-409.

Banshidhar and Deepmala. (2013). Current Researches on Plants having Antidiabetic Potential. *Journal of Botanical Science;* 2(2): 4-17.

Bennet, P.H. and Joslin. (1998). Diabetes mellitus Khan publication. *Waveryhey*; pp 193-200.

Bergmeyer, H.U., Bernt, E. (1974). Determination of glucose with glucose oxidase and peroxidase. In: HU Bergmeyer (Ed.), Methods of enzymatic analysis, VerlagChemie-Academic Press, New York: 1205-1215.

Bsoul, S. A. and Terezhalmy, G. T. (2014) Vitamin C in health and disease. *Journal of contemporary Dentistry;***15**: 1 – 13.

Caceres, A., Giron, L.M., Martinez, A.M. (2007). Diuretic activity of plants used for the treatment of urinary ailments in Guatimala. *Journal of Ethnopharmacology*;**19**: 233-245.

Chopra, R.N., Handa, K.L. and Kapur, L.D. (2013). Chopra's indigenous drugs. *IndiaJournal of Clinical Chemisry;* **18**: 499 – 520.

Clapp, W.L., Zhou, X.J., Laszik, Z., Nadasdy, T., D'Agati, V.D., Silva, F.G. (2009). Silva's Diagnostic Renal Pathology 2nd Edition. New York, NY: Cambridge University press. Page 86.

Dash, G.K., . Patro, C.H.P., mait; A.K. (2005). A study on the anti-hyperglycemic effect of *prema corymosa* POH *Journal of Natural Remedies;* 5(1): 31-34.

Davis, S.N and Granner, D.K. (2002). Insulin oral hypoglycemic agents, and the pharmacology of the endocrine pancreas. In: Hardman JG, Limbird LE, Gilman AG, editors. Goodman and Gilman's the pharmacological basis of therapeutics. 10th ed. New York: McGraw Hill Companies; pp. 1687–1690.

Edeoga, H.O., Okwu, D.E., and Mbaebie ,B.O. (2005). Phytochemical constituents of some Nigerian medicinal plants. *African Journal of Biotechnology;* 4 (7) 685-688.

Evans, W.C. (2009). Trease and Evans Pharmacognosy 16th ed. Saunders, Elsevier Ltd.China pp. 3-9.

Gupta, M.P, Solís, P.N., Calderón, A.I., Guinneau-Sinclair, F., Correa, M., Galdames, C., Guerra, C., Espinosa, A., Alvenda, G.I., Robles, G. and Ocampo, R. (2005). Medical ethnobotany of the Teribes of Bocas del Toro, Panama. *Journal of Ethnopharmacology*; 96:389-401.

Hashish, M.N. and Gomaa, N.F. (2003). The inhibitory effects of garlic (Allium sativa) on growth of some microorganisms. *Journal of Egpytian Public Health Association;* 78(5-6):361-372.

Iwalokun, B.A., Ogunledun, A., Ogbolu, D.O., Bamiro, S.B., Jimi- Omojola, J. (2004). In-vitro antimicrobial properties of aqueous garlic extract multi-drug resistant bacteria and Candida species from Nigeria. *Journal of Medicinal Food;*7(3):327-333.

Lawrence, D.R. and Bennett, P.N., (1995).Clinical Pharmacology ELBS with Churchill Livingston, Edinburgh, p. 686.

Lucy, B.J., Tijani, A.Y., Christiana, Y.I. (2014). Anti-ulcer and wound healing activities of *Sida corymbosa.African Journal of Traditional Medicine;* 11(1):87-92.

Narasinaha, T., Essiett, L., Okoko, E.L., Sunduraganmapathy, O., Morutima, R.N. (2013). Ad vent of civilization and key role of medicinal plant in human health care. *Plant Biological Intervention;* 34(12):12-21.

Okwu ,D. E., and Josiah, C. (2006).Evaluation of the chemical composition of two Nigerian medicinal plants. *African Journal of Biotechnology;* 5 (4): 357-361.

Pole, K., Sebastain, J. (2006). Ayurvedic medicine. Livinestone: 134.

Radhika, S., Senthil Kumar, R., Sindhu, S., Sagadevane and Arumugamp. (2013). phytochemicals investigation and evaluation of antihyperglycemic potential of *premna-corymbosa.International Journal of pharmacy and Pharmaceutical Sciences;*5(4):352-356.

Sahu, N.P., Banerjee, S., Mondal, N.B. and Mandal, D. (2008). Steroidal saponins. In: Fortschritte der Chemie Organischer Naturstoffe/progress in the chemistry of organic natural products, fortschritte der chemie organischer naturstoffe/progress in the chemistry of organic natural products, vol 89. Springer, Vienna, pp 45–141

Sinclair, S. (1998). Chinese herbs: a clinical review of Astragalus, Ligusticum.

Sivarajan VV, Pradeep KA, (2006), Malvaceaeof Southern Peninsular India: A taxonomic monograph Daya Publishing House, New Delhi.

Sparg, S.G., Light, M.E., Staden, J.(2004). Biological activities and distribution of plant saponins. *Journal of Ethnopharmacology;*94:219–243.

World Health Organisation (WHO) (2013), Quality control methods for medicinal plant material. WHO/PHARM, Geneva.

AUTHORS' CONTRIBUTIONS

All authors (Ezeugwunne IP, Ebezue CU, Ogbodo EC, Analike RA, Ezego WA, Onah CE, Madukwe DUP, Okwara JE, Amah UK, Oguaka VN, Oha PC, Asebioyo SJ.) contributed to the completion of this research work and were actively involved in the presentation of this manuscript.