wjpmr, 2023, 9(7), 56-59

SJIF Impact Factor: 5.922

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

EFFECTS OF AQUEOUS STEM EXTRACT OF *COSTUS AFER* ON SOME BIOCHEMICAL1 PARAMETERS IN MALE ALBINO WISTAR RATS

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Article Received on 13/05/2023 **Article Revised on 02/06/2023** **Article Accepted on 23/06/2023**

ABSTRACT

Costus afer leave when chewed is used to treat severe dehydration and diabetes mellitus in South-East Nigeria. This study evaluated the effect of *Costus afer* aqueous stem extract on some biochemical parameters in male albino wistar rats. 20 male rats were divided into 4 random groups of 5 animals each and were treated as follows: group 1 (normal control); group II (50mg/kg of *C. afer* stem extract); group III (100mg/kg of *C. afer* stem extract); group IV (150mg/kg of *C. afer* stem extract). The liver, kidney and lipid profile assays were done using Randox Laboratory kits. Results showed a statistically significant increase ($p \leq 0.05$) in the levels of alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), high density lipoprotein (HDL) in treated animals when compared with normal control. There was no significant change ($p \geq 0.05$) in the levels of creatinine in treated animals when compared with control. In conclusion, *Costus afer* stem extract is anti-lipidaemic but hepatotoxic and should be used with caution.

KEYWORDS: anti-lipidaemic, alanine transaminase, creatinine, high density lipoprotein, liver.

INTRODUCTION

Plants contain natural compounds with biological activities and this has attracted the interest of man in the use of these medicinal plants in the treatment and prevention of various ailments especially in less developed countries where man has tried to treat diseases and lessen pain using plants with bioactive phytochemicals (Enwuru *et al*, 2008). Early humans in their quest to treat sicknesses with what was readily available embarked on the use of plants to treat such illnesses. The history of medicinal plant is therefore as old as the existence of mankind (Anyanwu *et al*, 2008). About 80% of the world population, predominantly in Africa still depends on various ethnomedicine as the primary means of treating various illnesses (Parsaeimehr *et al*, 2017; Hudaib *et al*, 2008). Easy affordability, limited side effects and the fact that these herbs are readily available are some of the factors encouraging their uses in ethnopharmacology. Though most medicinal plant products are safe and non-toxic, however, some may be toxic and hence require safety assessment before use (Theophine *et al*, 2014). Over half a million plants all over the world are yet to be assessed for their toxicity and ethnomedicinal activities, hence more research into the medicinal activities of these plants will provide a great insight into their uses in the treatment of diseases that afflict mankind (Shankar, 2016).

The genus *Costus* is made up of over 150 species of perennial, rhizomatous herbs of which *Costus afer* Ker-Gawl is a member (Edeoga and Okoli, 2000). It is commonly known as Ginger lily, spiral ginger and bush cane but the yorubas of Nigeria call it Ire Omode, Igbos call it Okpete and it is known as Mbriten and Kakizawa in Efik and Hausa respectively (Oliver, 1960). The plant bears white and yellow flowers and is commonly found in river sides of Senegal, sirra leone, guinea, ghana as well as south-east and south-west Nigeria (Edeoga and Okoli, 2000). The leaves are chewed for treatment of moderate-severe dehydration. In south-east, it is revered for its anti-inflammatory, antidiabetic, antiarthritic, diuretic and purgative potentials (Sonibare *et al*, 2023).

Though various researches on the leaves of *Costus afer* has shown it to have antidiabetic (Uwah *et al*, 2015), anti-inflammatory and analgesic effects (Anyasor *et al*, 2015; Ijioma *et al*, 2014), there is limited data on the effects of the plant stem extract on some biochemical parameters (liver, kidney and lipid profile parameters) in wistar rats. This study is therefore to evaluate the effects and toxicity profile of aqueous stem extract of *Costus afer* as it affects the liver, kidneys and lipid profile of male wistar rats. This is to ensure the safety of the extract before clinical use.

MATERIALS AND METHODS

Identification and collection of plant materials
Fresh stem of *Costus afer* were harvested from the river side area of Aba, Abia state. The plants were identified and authenticated by a taxonomist A.A. Omenihu of Abia State University, Uturu before processing.

Preparation of plant materials
Samples of *Costus afer* stem were kept in the open under shade for 5 days to lose moisture after which the stems were cleaned and pounded in a clean mortar. The powdered plant stem (600g) was extracted with water using Soxhlets extractor. The solvent was evaporated using rotary evaporator and a dark brown residue obtained was kept safe in a sealed container and stored in a refrigerator.

Animals and experimental design
Twenty male wistar rats weighing 130g-180g were purchased from the animal house department of biochemistry, federal university of technology Owerri. They were housed in standard cages and allowed 2 weeks to acclimatize at a temperature 22-25^{0}C, 12 hrs light/day cycle before commencement of experiment. Animals were allowed access to rat chow (product of Vita Feeds Nig. Ltd) and water *ad libitum*. Aqueous extract of *Costus afer* were administered to the rats orally using an oral gastric tube. The extract administration lasted for 21 days.

Animals were divided into four groups of five animals each.

Group I: normal rat chow + water
Group II: rat chow + 50mg/kg of *Costus afer* extract
Group III: rat chow + 100mg/kg of *Costus afer* extract
Group IV: rat chow + 150mg/kg of *Costus afer* extract

Blood collection and serum chemistry assay
On the 22nd day, animals were fasted overnight, anaesthesized with chloroform and blood samples from each animal collected via cardiac puncture. The blood samples were put into plain sample container and allowed to stand for 15 minutes to clot and centrifuged to get serum. The serum was put into sterile sample test tubes for the measurement and evaluation of liver biomarkers (alanine transaminase, aspartate transaminase alkaline phosphatase, total protein, albumin, total bilirubin and direct bilirubin), kidney profile (electrolyte: {Na+, K+, Cl-, HCO3-}, urea and creatinine) and lipid profile (total cholesterol, high density lipoprotein, low density lipoprotein and triglycerides). All the biochemical assays were determined using ready to use kits from Randox Laboratory Ltd, Co. Antrim, UK.

Statistical analysis
Statistical analysis was performed using one-way analysis of variance (ANOVA) with R^{TM} statistics software package, version 3.0.3. The normal distribution of the data and homogeneity of variance was tested by Barklett homogeneity test. One-way ANOVA with a turkey test post hoc was used to identify statistical deifferences among groups. A p- value of $\leq$ 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Table I: Liver function status of rats following moderate administration of *Costus afer* stem extract.

PARAMETERS	Group I	Group II	Group III	Group IV
ALT (IU/L)	20.03 ± 0.38^a	23.86 ± 0.40^b	27.15 ± 0.23^c	30.03 ± 0.23^d
AST (IU/L)	49.51 ± 1.47^a	58.24 ± 1.05^b	67.91 ± 0.72^c	87.99 ± 0.86^d
ALP (IU/L)	59.97 ± 0.36^a	67.86 ± 0.26^b	74.20 ± 0.77^c	82.01 ± 0.33^d
Total protein (mg/dl)	5.99 ± 0.12^d	5.77 ± 0.09^c	5.59 ± 0.07^b	5.25 ± 0.07^a
Albumin (mg/dl)	4.47 ± 0.04^d	4.37 ± 0.01^c	4.04 ± 0.03^b	3.83 ± 0.03^a
Total bilirubin (mg/dl)	0.60 ± 0.04^c	0.55 ± 0.33^b	0.53 ± 0.05^b	0.47 ± 0.03^a
Direct bilirubin (mg/dl)	0.07 ± 0.06^a	0.14 ± 0.02^b	0.20 ± 0.02^c	0.22 ± 0.02^c

n=5. Value is mean ± standard deviation, mean across the row with different alphabetical superscripts indicates a significant different (P<0.05)

Table II: Kidney function status of rats following sub-chronic administration of *Costus afer* stem extract.

Parameters	Group I	Group II	Group III	Group IV
Urea	19.87 ± 0.05^a	22.12 ± 0.47^b	25.23 ± 0.60^c	27.84 ± 0.48^d
Creatinine	0.58 ± 0.04^a	0.59 ± 0.07^a	0.62 ± 0.04^a	0.65 ± 0.05^a
Sodium	144.16 ± 0.89^a	147.83 ± 0.88^b	150.12 ± 0.54^c	154.47 ± 0.08^d
Chloride	100.22 ± 0.68^a	101.54 ± 0.60^b	102.54 ± 0.64^c	104.68 ± 0.55^d
Bicarbonate	30.00 ± 0.11^d	29.93 ± 0.22^c	28.21 ± 0.09^b	26.24 ± 0.23^a
Potassium	5.00 ± 0.02^a	5.19 ± 0.04^b	5.38 ± 0.05^b	5.68 ± 0.03^a

n=5. Value is mean ± standard deviation, mean across the row with different alphabetical superscripts indicates a significant different (P<0.05).

Table III: Lipid profile of rats following administration of the stem extract *Costus afer.*

Parameters	Group I	Group II	Group III	Group IV
Cholesterol mg/dl	178.09 ± 1.91^{c}	172.72± 2.45^{b}	167.38± 3.81^{a}	164.38± 1.01^{a}
HDL (mg/dl)	44.96 ± 1.51^{a}	45.07 ± 1.05^{a}	45.84 ± 074^{a}	47.07 ± 0.86^{b}
LDL (mg/dl)	129.62± 2.13^{d}	124.54 ± 1.98^{c}	118.30± 4.04^{b}	114.06 ± 143^{a}
TG (mg/dl)	130.46 ± 178^{a}	126.24± 2.10^{b}	121.50 ± 1.90^{c}	120.65± 2.24^{d}

n=5. Value is mean ± standard deviation, mean across the row with different alphabetical superscripts indicates a significant different ($P<0.05$)

RESULTS AND DISCUSSION

Assessment of liver, kidney and lipid profile is an indispensable tool is toxicological evaluation of drugs and plant extracts as the liver and kidney play a great role in xenobiotic metabolism. Liver, kidney and lipid profile assays are a panel of investigations that reveals the status of the above organs and they serve as an essential tool for diagnosis of cardiovascular diseases and to a lesser extent diabetes mellitus (Pischon *et al*, 2005; Jugner *et al*, 2006) and cancer (Santos and Schulze, 2012).

Levels of ALT, AST, ALP and albumin gives information about the functionality, cellular integrity and link to the biliary tract (Ezejiofor *et al*, 2013). Increase in levels of transaminases especially ALT signals hepatic damage which leads to increase in cell membrane permeability and cytosolic leakage as is seen in liver cell necrosis and liver cirrhosis (Simmons *et al*, 1995).

Table 1 shows the effect of aqueous stem extract of *Costus afer* on liver function parameters in male albino wistar rats. There was a statistically significant ($p\leq0.05$) and dose-dependent increase in the levels of alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP) and direct bilirubin in test animals when compared with control. Also, serum levels of total protein and albumin decreased significantly ($p\leq0.05$) in group II-IV rats when compared with group I rats which served as the control. The increase in levels of liver enzymes, bilirubin and liver proteins which serve as indicators of liver damage after sub-chronic administration shows that our extract is hepato-toxic especially at high doses. Reduced levels of albumin and total protein points to a defective synthetic function of the liver or altered hepatocellular function. Our findings are in consonance with those of Ezejiofor *et al*, 2013 in which administration of aqueous leaf extract of *Costus afer* on male wistar rats led to hepatotoxicity in such rats.

Alteration of kidney function parameters is one of the major herbs related complications and is characterized by cellular necrosis and damage to intracellular organelles (Joy and Nair, 2008). Traditional kidney biomarkers which serve as indicators of kidney damage are serum urea, creatinine and electrolytes (Na+, K+, Cl- and HCO3-). Table II shows the kidney function status of rats following a 21day administration of stem extract of *Costus afer*. Our results showed no statistically significant difference ($p\geq0.05$) in the levels of creatinine in group II-IV animals when compared to the control. This is similar to the results of a research by Ezejiofor *et al*, 2013 and Mordi *et al*, 2021 which showed that *Costus afer* extract is not nephrotoxic but rather plays a role in nephron-protection of kidneys of rats with crude oil induced toxicity.

In the present study, administration of 50mg/kg, 100mg/kg and 150mg/kg of *Costus afer* stem extract led to a statistically significant ($p\leq0.05$) in the levels of cholesterol, low density lipoprotein and triglyceride when compared with the normal control animals that received rat chow and water. However, the serum concentration of high-density lipoprotein generally described as good cholesterol significantly increased ($p\leq0.05$) when compared with control. Phytochemical analysis of *C. afer* revealed the presence of tannins, saponins, glycosides, alkanoids and flavonoids (Arhoghro *et al*, 2014) and results have shown that these phytochemicals play a significant role in lipid lowering potentials of most plants (Gaamousi *et al*, 2010). Increased levels of HDL on administration of the extract shows that the extract is cardioprotective and antiartherogenic. HDL inhibits LDL oxidation by metals, counteracts LDL oxidation resulting in its antiartherogenic effects (Nwankpa *et al*, 2019).

CONCLUSION

Though *C. afer* stem extract has antilipidaemic effect as evidenced in this study, its intake should be regulated and the extract should be detoxified before usage to expunge some of the toxic substances that are responsible for the hepatotoxicity as is seen in this study.

REFERENCES

1. Enwuru, NV, Ogbonnia, SO and Nkemehule, F. (2008). Evaluation of Antibacterial Activity and Acute Toxicity of the Hydroethanolic extract of *Stachytarpheta angustifolia* (Mill) Vahl. *African Journal of Biotechnology*, 7(11): 1740- 1744.
2. Anyanwu, CU and Nwosu, G.C. (2014). Assessment of the antimicrobial activity of aqueous and ethanolic extracts of Piper guineese leaves. *Journal of Medicinal Plant Research*, 8(10): 337-439.
3. Parsaeimehr, A., Martinez-Chapa, S.O., Parra-Saldívar, R. (2017). Medicinal Plants Versus Skin Disorders: A Survey from Ancient to Modern Herbalism. *The Microbiology of Skin, Soft Tissue, Bone and Joint Infections*, 2(13): 205-221.
4. Hudaib, M., Mohammaa, M., Bustanji Y., Tayyma R., Yousef M., Aburjai T. (2008). Ethno Pharmacological survey of medicinal plants in

Jordan, Mujib nature reserve and surrounding area. *Journal of Ethnopharmacology*, 120: 63-71.
5. Theophine, C, Phillip, F., Collins, A. and Emeka, K. (2014). Safe African Medicinal Plants for Clinical Studies. *Toxicological Survey of African Medicinal Plants*, 535-555.
6. Shankar, Mani. (2016). Importance and uses of medicinal plants – an overview. The Asian Conference on Sustainability, Energy and the Environment 2013 Official Conference Proceedings Osaka, Japan 606. *International Journal of Preclinical and Pharmaceutical Research*, 7: 67.
7. Edeoga, H. and Okoli, B. (2000). Chromosome numbers of *Costus lucanusianus* (Costaceae) in Nigeria. *Folia Geobotanica*, 35: 315–318.
8. Oliver B. Ibadan: Nigerian College of Arts, Sci and Tech, University Press Nigeria; 1960. *Medicinal Plants in Nigeria*, 1–33.
9. Sonibare, M.A., Isola, A.O. and Akinmurele, O.J. (2023). Pharmacognostic standardisation of the leaves of Costus afer Ker Gawl. (Zingiberaceae) and Palisota hirsuta (Thunb.) K. Schum. (Commelinaceae). *Future Journal of Pharmaceutical Sciences*, 9: 19-23.
10. Uwah, AF., Ewere, EG. and Ndem, JI. (2015). Hypoglycemic and haematologic effects of crude stem juice of *Costus afer* on alloxan induced diabetic wistar rats. *American Journal of Ethnomedicine*, 2(4): 2348–9502.
11. Anyasor, GN., Funmilayo, O., Odutola, O., Olugbenga, A. and Oboutor, EM. (2015). Evaluation of *Costus afer* Ker Gawl. In vitro anti-inflammatory activity and its chemical constituents identified using gas chromatography mass spectrometry analysis. *Journal of Coastal Life Medicine*, 3(2): 132–138.
12. Ijioma, SN., Nwosu, CO., Emelike, CU., Okafor, AI. and Nwankwo, AA. (2014) Antinociceptive property of *Costus afer* Ker gawl stem juice and ethanol leaf extract in albino rats. Comprehensive Journal of Medical Sciences, 2(2): 14–19.
13. Pischon, T., Girman, C.J., Sacks, F.M., Rifai, N., and Stampfer, MJ and Rimm, E. (2005). Non-high-density lipoprotein cholesterol and apolipoprotein B in the prediction of coronary heart disease in men. *Circulation*, 112: 3375-3383.
14. Jungner, I. Walldius, G., (2006). The apoB/apoA-I ratio: a strong, new risk factor for cardiovascular disease and a target for lipid-lowering therapy—a review of the evidence. *Journal of Internal Medicine*, 259: 493-519.
15. Santos, C.R., and Schulze, A. (2012). Lipid metabolism in cancer. *FEBS Journal*, 279: 2610-2623.
16. Ezejiofor, AN., Orish, CN. and Orisakwe, OE. (2013). Effect of aqueous leaves extract of *Costus afer* Ker Gawl (Zingiberaceae) on the liver and kidney of male albino Wistar rat. Ancient Science of Life, 33(1): 4-9.
17. Simmons, JE., Yang, RS.and Berman, E. (1995). Evaluation of the nephrotoxicity of complex mixtures containing organics and metals: Advantages and disadvantages of the use of real-world complex mixtures. *Environmental Health Perspective*, 103(1): 67–71.
18. Joy, J. and Nair, CK. (2008). Amelioration of cisplatin induced nephrotoxicity in Swiss albino mice by Rubia cordifolia extract. *Journal of Cancer Research and Therapeutics*, 4: 111–115.
19. Mordi, J.C., Achuba, F. I., Ichipi-Ifukor, P. C., Emete, G., Mokogwu, A. T. H., Nmanedu, A. C., Aruoren, O., & Ohwokevwo, O. A. (2021). Protective influence of *Costus afer* Aqueous Extract in Rats Fed with Crude Oil Contaminated Diet as Measured by Employing Biochemical Indices. *Iraqi Journal of Science*, 62(12): 4639–4648.
20. Arhoghro, E.M., Berezi, E.P. and Prohp T.P. (2014). Phytochemical Constituents and Effect of Combined Ethanolic Leaf Extract of *Costus afer* and *Cleome rutidosperma* on Lipid Profile and Some Haematological Parameters in Wistar Rats. *International journal of current microbiology and Applied Sciences*, 3(5): 673-679.
21. Gaamousi, F., Israel, N., and Lyoussi, B. (2010). Hypoglycemic and hypolipidemic effects of an aqueous extracts of *Chemaeropshumilis* leaves in obese, hyperglycaemic and hyperlipidaemic Merionesshawi rats. *Pak. J. Pharm*, 23(2): 212–319.
22. Nwankpa, Promise, Ugwuezumba, P.C., Ekweogu, C.N., Etteh, C.C., Emengaha, F.C. and Egwurugwu, J.N. (2019). Assessment of Ethanol Stem Extract of *Dennettia tripetala* on Lipid Profile and Antioxidant Status in Rats Administered Thermoxidized Palm Oil. *East African Scholars Journal of Medical Sciences*, 2(6): 346-371.