



## Effects of aqueous leaf extract of *Telfairia occidentalis* on acyclovir induced renal damage in adult Wistar rat

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**ABSTRACT:** This study investigated the effects of aqueous leaf extract of *Telfairia Occidentalis* on acyclovir-induced renal damage in the kidneys of adult Wistar rats. A total of thirty adult Wistar rats weighing an average of 200g were used for this study. They were randomly grouped into six (A, B, C, D, E and F), with each group consisting of five rats each. Group A was given distilled water, group B was administered with 400mg/kg body weight of aqueous leaf extract of *T. Occidentalis*, group C was administered 1000mg/kg body weight of aqueous leaf extract of *T. Occidentalis*, group D was administered 28mg/kg body weight of acyclovir, Group E was administered 400mg/kg body weight of aqueous leaf extract of *T. Occidentalis* and 28mg/kg body weight of acyclovir and Group F was administered 1000mg/kg body weight of aqueous leaf extract of *T. Occidentalis* and 28mg/kg body weight of acyclovir. Aqueous leaf extract of *T. Occidentalis* and acyclovir were given via orogastric method. Biochemically, group D showed elevation of urea, creatinine, SOD and CAT levels statistically, while other groups revealed reduction in the urea, creatinine, SOD and CAT values statistically. Histological results showed that there was inflammation, vascular distortion and tubular necrosis in the kidney of Group administered with only acyclovir while there was protection in the kidney of rat administered with aqueous leaf extract of *T. Occidentalis* and acyclovir. In conclusion, aqueous leaf extract of *T. Occidentalis* has the potential to protect the kidney from acyclovir induced renal damage in adult Wistar rat.

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Acyclovir remains essentially unchanged in uninfected cells; consequently, there is little interference with cellular DNA synthesis (Elion, 1983; Furman *et al.*, 1984; McGuirt *et al.*, 1984). *Telfairia occidentalis* can survive for 3-4 years if there is moisture in the soil (Achinewu, 1997). It has been reported to contain tannins, flavonoids, alkaloids, saponins, steroids and, anthraquinones, (Eseyin *et al.*, 2000). The presence of long chain n-3-unsaturated fatty acid in the leaf has also been reported. Palmitoleic acid (16.62%) and elaidic acid (0.85%) are the predominant omega 9 fatty acids present in the leaf

(Inuwa *et al.*, 2012). The carbohydrate content of the leaf is 25% (Akwaowo *et al.*, 2000). It have anxiolytic and sedatives properties (Akindele and Ajao, 2013), blood coagulation (Nubila *et al.*, 2013), immunomodulatory (Egba *et al.*, 2013a; Egba *et al.*, 2013b), phytoextraction (Iyagba and Offor, 2013), testiculoprotective (Akang *et al.*, 2010), amelioration of radiation-induced testicular injury (Adejuwon *et al.*, 2014), cancer chemopreventive (Iweala and Obidoa, 2009), hepatoprotective (Ekpenyong *et al.*, 2012), anti-anaemic (Alada, 2000) anti-convulsant (Gbile, 1986). The objective of the study is to investigate the

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effects of aqueous leaf extract of *Telfairia occidentalis* on acyclovir induced renal damage in adult Wistar rat.

## MATERIALS AND METHODS

**Plant Collection and Identification:** The leaves of *Telfairia Occidentalis* were identified by a plant taxonomist in the department of plant biology and biotechnology, faculty of life sciences, University of Benin, Benin city, Edo state, Nigeria.

**Extract Preparation:** The collected leave samples were chopped into particles and air-dried for a week. It was then oven-dried at a temperature of 40°C for about 30 minutes and then pulverized into powder form using the British Milling Machine. The Weight of the powdered sample was then actualized to 100g. The powdered material was macerated by soaking the 110g powdered *Telfairia Occidentalis* leaves sample in 1.7L of water for 24 hours at room temperature with constant shaking and stirring every seven hours (7). Filtration was carried out to separate the residue from the filtrate and the filtrate was concentrated over hot water bath using crucibles to obtain a paste like extract which was then preserved in a sample bottle inside a refrigerator.

**Collection of Drug Material:** Aciclovir, a product of Ranbaxy laboratories pharmaceutical company was obtained with a batch number of P618O443/0 and was purchased from God Favour Medical centre, Benin City.

**Animal Care:** Thirty (30) adult Wistar rats with an average weight of 200g were used for this study. The animals were purchased and maintained in the animal house of the department of anatomy, University of Benin, Benin City. They were kept in cleaned cages, maintained at room temperature and allowed free access to drinkable water and rat feed. The animals were acclimatized for two weeks before the commencement of the experiment.

**Experimental Design:** Thirty (30) Adult Wistar rats were randomly selected into a control group (group A) and five treatment groups (B, C,D,E and F) each containing five (5) animals (n= 5 per group). The animals in each cage were given growers' mash, manufactured by premier feed mills co Ltd (a subsidiary of flour mills of Nigeria Plc.) and water.

The experimental design is shown as follows;

Group A: control group, received normal rat feed and water.

Group B: 400mg/kg body weight of aqueous leaf extract of *Telfairia Occidentalis*

Group C: 1000mg/kg body weight of aqueous leaf extract of *Telfairia Occidentalis*

Group D: 28mg/kg body weight of acyclovir

Group E: 400mg/kg body weight of aqueous leaf extract of *Telfairia Occidentalis* and 28mg/kg body weight of acyclovir

Group F: 1000mg/kg body weight of aqueous leaf extract of *Telfairia Occidentalis* and 28mg/kg body weight of acyclovir.

orogastric tube was used during the course of administration. This is to ensure that each animal properly received its dose. The experiment was done for 35days

**Sacrifice of the animals:** At the end of the experimental period, the animals were grossly observed for general physical characteristics, and weighed using a top loader weighing balance. A midline abdominal incision was made through the ventral wall of the rats under mild anesthesia using chloroform. Blood was taken from the inferior vena cava and kept in blood (heparin) bottles for renal function test and EDTA bottles for antioxidant assay analysis. The kidney was harvested and fixed in 10 % formal saline for histological analysis.

The tissues were dehydrated in ascending grades of alcohol (ethanol), cleared in xylene and embedded in paraffin wax. The deparaffinised sections were stained routinely with Hematoxylin and Eosin.

**Photomicrography:** The histological sections of the renal tissues were examined under Leica DM750 research microscope with a digital camera Leica ICC50) attached. Digital photomicrographs of the tissue sections were taken at x40 and x100 magnifications. Creatinine was determined according to Henry *et al.* (1974), while Urea was assayed according to (Chaney and Marbach, 1962). The activity of CAT was assayed by the method of Aebi (1984). SOD activity was determined by the method of Nishikimi *et al.*, 1972.

**Statistical analysis:** All data were subjected to statistical analysis using the IBM SPSS statistics software

Statistical Package for Social Science) Version 25 (SPSS, Inc., Chicago, Illinois, USA) and relevant statistical values were obtained. The values of the treated groups were compared with those of non-treated group using the one-way analysis of variance (ANOVA) and the T-test method. Values of P < 0.05 were considered significant. LSD was used as the post-hoc test.

## RESULTS AND DISCUSSION

**Biochemical characterization:** Biochemically, Marwa, (2022) evaluated the effect of vitamin D on acyclovir induced kidney injury in adult Wistar rat. The researcher discovered that acyclovir was able to caused renal toxic effects as indicated by SOD, MDA, biochemical, histological, and immunohisto-chemical alterations. These results are in correlation with our acyclovir study on the kidney of adult rats in table 1. Where we discovered that there was significant increase in the level of urea and creatinine when compared with control and the treated groups. Groups that were given *T. occidentalis* only, and those given *T. occidentalis* along with acyclovir showed significant reduction in the level of urea and creatinine. This result is supported by earlier work done by Seyifunmi (2023). He studied the nephroprotective effect of *Telfairia occidentalis* leaf

extract against oxidative stress-induced kidney damage with 2, 4-dinitrophenyl hydrazine in Albino rats. He discovered that leaf extract of *Telfairia occidentalis* helps to mitigate the oxidative damage caused by 2,4-dinitrophenyl hydrazine and concluded that the extract consumption can help to heal oxidative damage condition and protect against deleterious effect of oxidative stress on the kidney. Also, Akindele et al 2018 assessed the toxicity of the hydroethanolic leaf extract of *Telfairia occidentalis* in rats. They discovered that *T. occidentalis* extract at 400 mg/kg dose did not caused significant changes in SOD, CAT and MDA levels. Their results suggested that the extract at the 400 mg/kg dosage did not cause changes in the antioxidant status in the kidney of the rat. These results are also in correlation with our *T. occidentalis* study on the kidney of adult Wistar rats (table 1)

**Table 1:** Showing the mean values of serum creatinine, urea, CAT and SOD concentration after the administration of *T. Occidentalis* aqueous leaf extract and acyclovir on Wistar rats

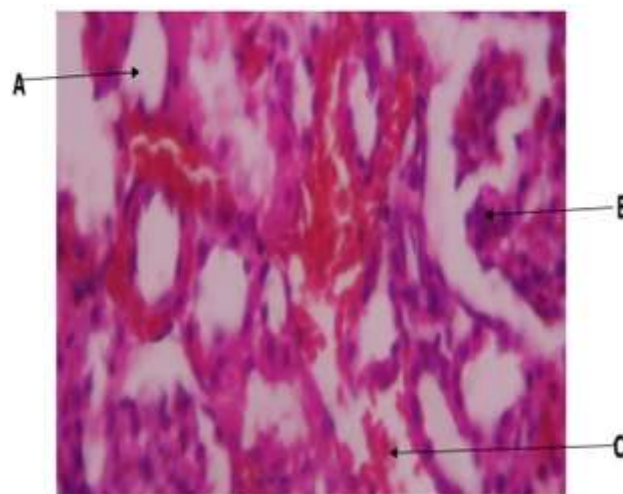
|                          | Control         | 400 mg/kg<br><i>T.</i><br><i>Occidentalis</i> | 1000 mg/kg<br><i>T.</i><br><i>Occidentalis</i> | Acyclovir<br>only | 400 mg/kg<br><i>T. Occidentalis</i> +<br>28 mg/kg<br>Acyclovir | 1000 mg/kg<br><i>T. Occidentalis</i><br>+ 28 mg/kg<br>Acyclovir |
|--------------------------|-----------------|-----------------------------------------------|------------------------------------------------|-------------------|----------------------------------------------------------------|-----------------------------------------------------------------|
| Urea (mg/dl)             | 24.90 ±<br>1.10 | 36.90<br>± 0.20                               | 32.80<br>± 0.36                                | 89.10<br>± 0.64*  | 37.20 ± 0.41                                                   | 39.50 ± 0.22                                                    |
| Creatinine<br>(mg/dl)    | 0.62 ±<br>0.04  | 0.66<br>± 0.05                                | 0.76<br>± 0.21                                 | 2.91<br>± 0.18*   | 0.74 ± 0.11                                                    | 0.87 ± 0.10                                                     |
| CAT<br>(unit/mg protein) | 33.78 ±<br>1.60 | 33.25<br>± 1.10                               | 35.62<br>± 1.20                                | 71.47<br>± 1.31   | 34.12 ± 1.60                                                   | 35.92 ± 1.81                                                    |
| SOD<br>(unit/mg protein) | 13.12<br>± 1.43 | 14.86<br>± 0.28                               | 15.03<br>± 0.51                                | 56.03<br>± 0.84   | 16.01 ± 0.29                                                   | 16.08 ± 0.76                                                    |

\* P < 0.05 indicates significant difference when other groups are compared with the control (group A).

**Histological Characterization:** Plate 1, which is the control slide showed features of normal glomerulus, tubules and interstitial space and this plate will act as reference point for groups that was given *Telfairia occidentalis* only at both low and high doses, acyclovir only group, and the treated groups. At a dose of 400mg/kg of the extract (plate 2), there was no abnormal histologically changes noticed.

The kidney slide showed features of normal glomerulus and tubules. This features may arises due to the non- toxic nature of the extract. This observation is supported by earlier work done by Marianna et al (2009). They stated that the seed oil of the extract is edible and as a nutraceutical activity.

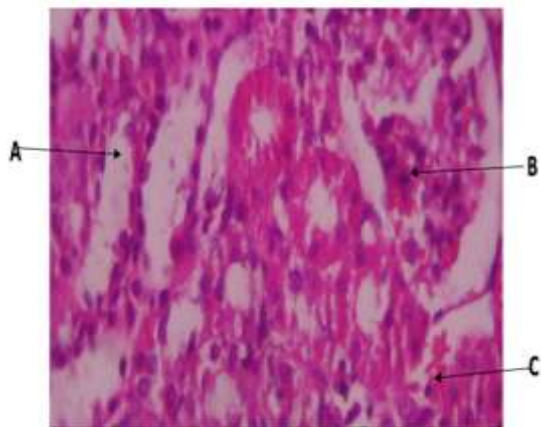
Ogunka- Nnoka *et al.* (2017) also reported that methanolic leaf extracts of *Telfairia occidentalis* restored back the functionality of the rat kidney injured with copper intraperitoneally by decreasing elevated levels of urea and creatinine, thus suggesting the nephroprotective activity of *Telfairia occidentalis* leaf extracts.



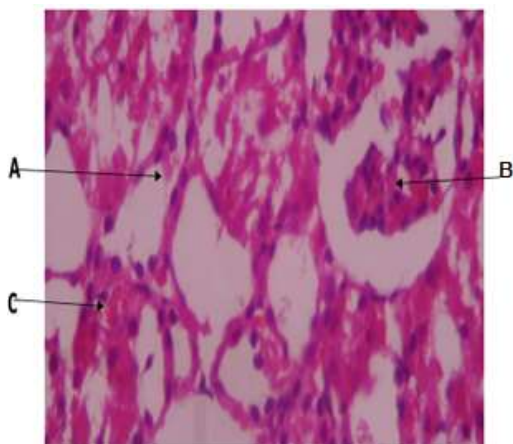
**Plate 1:** Kidney control composed of normal A: tubules, B: glomerulus, C: interstitial space (HEX400)

Herbal leaves are widely accepted to have a curative effect among the people of the third world countries (Ehimigbai and Aneke 2015). *Telfairia Occidentalis* leaf is a vegetable that have a strong antioxidant activity that might be attributed to their phenolic and

vitamin composition (Mohammed et al 2012). The leaves and seeds of *Telfairia Occidentalis* are widely consumed due to its potential health benefits (Oyewole and Abalaka, 2012). This observation also agreed with our findings in plate 3 where at 1000mg/kg of *Telfairia Occidentalis*, the kidney shows features of normal glomerulus and tubules.

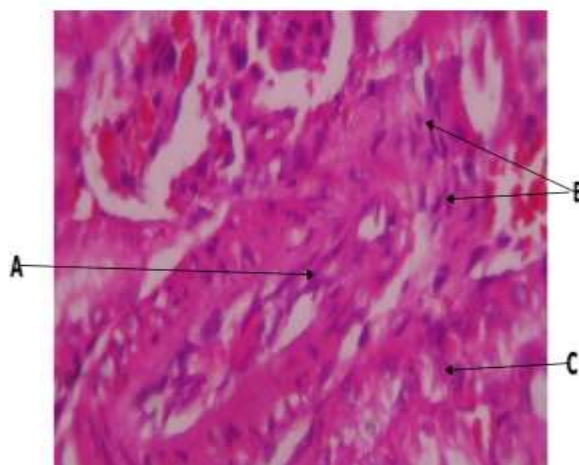


**Plate 2:** Kidney of rat given low dose of *Telfairia Occidentalis* only showing A: normal tubules B: glomerulus and C: congested interstitial space (HEX400)

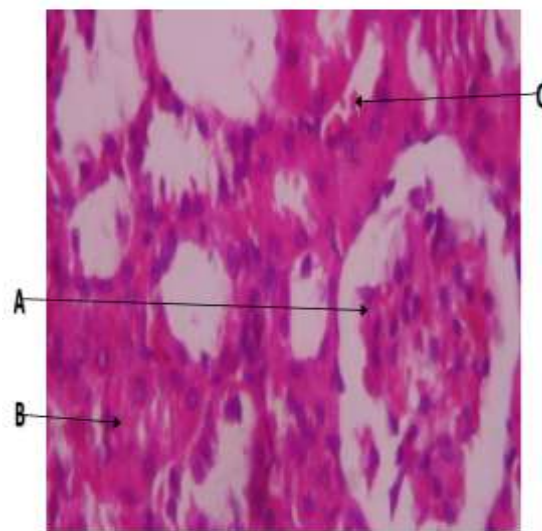


**Plate 3:** Kidney of rat given high dose of *Telfairia Occidentalis* only showing A: normal tubules B: glomerulus and C: congested interstitial space (HEX400)

Furthermore, Campos *et al* (1992) investigated the renal effects of acyclovir at 100 mg/kg body weight given via intra peritoneum for 7 days in rat. They concluded that high doses of acyclovir produce azotemia and an abnormal function of the proximal tubule and thick ascending limb associated with resistance to vasopressin of the inner medullary collecting duct of the kidney. Histologically, their outcome is consistent with our work, where we discovered that acyclovir was able to cause renal injury as evidence by severe vascular necrosis and obstruction, peri-vascular mobilization of inflammatory cells, tubular necrosis and interstitial congestion (plate 4).

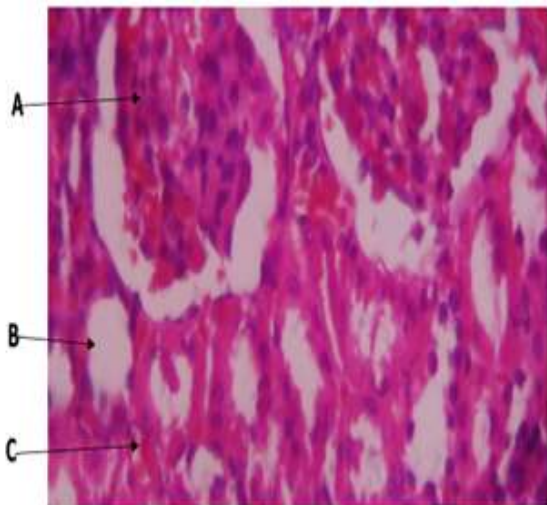


**Plate 4:** Kidney of rat given acyclovir only showing A: severe vascular stenosis and obstruction B: perivascular mobilization of inflammatory cells C: tubular necrosis (HEX400)



**Plate 5:** Kidney of rat given acyclovir + low dose of *Telfairia Occidentalis* showing A: normal glomerulus B: focal tubular necrosis and C: congested interstitial space (HEX400)

Inclusively, Maduka *et al* (2017) studied the effect of aqueous leaf extract of *Telfairia occidentalis* on gentamycin induced kidney damage. They concluded that the administration of the extract together with and after the administration of gentamycin reverses the renal damage caused by gentamycin. Their result is in accordance with our study (plate 5) where we discovered that *Telfairia occidentalis* leaf was not toxic to the rat at a low dose and the extract was also able to ameliorate the cytotoxic effect of acyclovir on the kidney of adult wistar rat due to its phenolic content.



**Plate 6:** Kidney of rat given acyclovir + high dose of *Telfairia Occidentalis* showing A: normal glomerulus B: focal tubular necrosis and C: congested interstitial space (HEX400)

Additionally, Usunobun *et al* (2023) bring to bear that *T. occidentalis* nephroprotective effect is associated with its ability to improve renal function parameters as it may have increased glomerular filtration rate resulting in reduce serum creatinine and urea level. This detoxification capacity of *T. occidentalis* may also be responsible for its protective effect against CCl<sub>4</sub> toxicity. Their exertion is in accordance with our observation in plate 6, in which acyclovir was given along with the extract at a dose of 1000mg/kg of the extract, we discovered that *T. occidentalis* was able to ameliorate the cytotoxic effect of acyclovir on the renal tissue as evidenced in plate 6. *T. occidentalis* leaves have been found to possessed advance antioxidant and detoxifying strength mainly because of its phytochemical content such as flavonoids which are known to reduce the generation of free radicals by aabnormal cells and act as scavengers for already formed free radicals.by the cells.

In conclusion, the aqueous leaves extract of *T. occidentalis* is not toxic and was able to ameliorate the acyclovir- induced kidney damage in an adult Wistar rat.

## REFERENCE

Achinewu, SC (1997). The nutritive evaluation of fermented fluted pumpkin seeds. *Discov. Innov.* 2: 62-66.

Adejuwon, SA; Omirinde, JO; Ebokaiwe, AP; Aina, OO; Adenipekun, A; Farombi, EO (2014). Radiation-induced Testicular Injury and Its Amelioration by *Telfairia occidentalis*. *Br. J. Med. Med. Res.* 4(12): 2431-2445.

Aebi, H (1984). Catalase in vitro. *Meth. Enzymol.* 105: 121-126.

Akang, EN; Oremosu, AA; Dosumu, OO; Noronha, CC; Okanlawon, AO (2010). The effect of fluted pumpkin (*Telfairia occidentalis*) seed oil (FPSO) on testis and semen parameters. *Agric. Biol. J. Am.* 1(4): 697-703.

Akindele, AJ; Ajao, MY. (2013). Anxiolytic and sedative properties of hydroethanolicextract of *Telfairia occidentalis* leaves in mice. *Rev. Bras. Farmacogn.* 23(2):301-309.

Akindele, AJ; Oladimeji-Salami, JA; Oyetola, RA; Osiagwu, DD (2018). Sub-Chronic Toxicity of the Hydroethanolic Leaf Extract of *Telfairia occidentalis* Hook. f. (*Cucurbitaceae*) in Male Rats. *Medicines (Basel).* 6; 5(1):4.

Akwaowo, E.U; Ndon, BA; Etuk, EU (2000). Minerals and antinutrients in fluted pumpkin (*Telfairia occidentalis*Hook. f.). *Food Chem.* 70(2):235-40.

Alada, ARA (2000). The haematological effects of *Telfairia occidentalis* diet preparation. *Afr. J. Biomed. Res.* 3: 185-186.

Campos, SB; Seguro, AC; Cesar, KR; Rocha, AS. (1992) Effects of acyclovir on renal function. *Nephron.* 62(1):74-9.

Chaney, AL; Marbach, EP. (1962). Modified reagents for determination of urea and ammonia. *Clin. Chem.* 8(2): 130-132.

Egba, SI; Ikechukwu, GC; Njoku, OU (2013a). Aqueous extracts of *Telfairia occidentalis* leaf reverses pyrogallol induced leucopenia and stimulates the immune system in Wistar albino rats. *J. Chem. Pharm. Res.* 5(4):149-153.

Egba, SI; Ikechukwu, GC; Njoku, OU (2013b). Immunomodulatory activity of ethanol extract of *Telfairia occidentalis* in Wistar albino rats. *The Expt.* 12(3): 791-800.

Ehimigbai, ARO; Aneke, AS (015). Ameliorative Effect of Aqueous Leaf Extract of Bitter leaf (*VernoniaAmygdalina*) on Rifampicin induced renal toxicity in adult wistar rats. *J. Med. Biomed. Res.* 14 (2). 31- 39

- Elion, GB (1983). The biochemistry and mechanism of action of acyclovir. *J. Antimicrob Chemother* 128: 9-17.
- Ekpenyong, CE; Akpan, EE; Udoh, NS. (2012). Phytochemistry and toxicity studies of *Telfairia occidentalis* aqueous leaves extract on liver biochemical indices in Wistar rats. *Am. J. M. Sc. 2*: 103-110.
- Eseyin, OA; Oforah, E; Dooka, BD (2000). Preliminary study of the hypoglycaemic action of the extract of leaf of *Telfairia occidentalis* in normoglycaemic guinea pigs. *Global J. Pure Appl. Sci.* 6: 639-641.
- Furman, PA; St. Clair, MH; Spector, T (1984) Acyclovir triphosphate is a suicide inactivator of the herpes simplex virus DNA polymerase. *J. Biol. Chem.* 259: 9575-9579.
- Gbile, ZO (1986). Ethnobotany, Taxonomy and Conservation of Medicinal Plants. In: Sofowora, A. (ed.). *The State of Medicinal Plants Research in Nigeria*, University of Ibadan Press, Ibadan, Nigeria.
- Henry, RJ; Cannon, DC; Winkelman, W (1974). *Clinical Chemistry Principles and Techniques*. 11th Edn. Harper and Row Publishers, New York, Pages: 1629
- Inuwa, HM; Aimola, IA; Muhammad, A; Habila, N; Okibe, P; Latayo, M; Ahmed, Z (2012). Isolation and determination of omega-9 fatty acids from *Telfairia occidentalis*. *Int. J. Food Nutr. Saf.* 1(1):9-14.
- Iweala, EEJ; Obidoa, O (2009). Some biochemical, haematological and histological responses to a long-term consumption of *Telfairia occidentalis*-supplemented diet in rats. *Pak J Nutr.* 8: 1199-1203.
- Iyagba, AG. ; Offor, US (2013). Phytoextraction of heavy metals by fluted pumpkin (*Telfaria occidentalis* Hooker F.) planted on oil contaminated soil amended with sawdust and siam weed (*Chromolaena odorata* (L.) R.M. King and Robinson) leaves. *Int. Res. J. Agric. Sci. Soil.* 3(12):422-426.
- Maduka, SO; Ugwu, CE; Onwudinjo, OJ (2017). The effect of aqueous leaf extract of *Telfairia occidentalis* (Cucurbitaceae) on gentamycin-induced renal damage. *Int. J. Basic. Clin. Pharmacol.* 28, 1, 11-17
- Marianna N; Tzortzis N; Elizabeth F (2009). Antioxidant and lipoxygenase inhibitory activities of pumpkin seed extracts. *Food Res Int.* 42:641-646
- Marwa, B. (2022). Evaluation of the effect of vitamin D on acyclovir-induced renal injury in adult male albino rat. *SAJEB.* 12 (1): 55-63.
- McGuirt, PV; Shaw, JE; Elion, GB; Furman, PA (1984) Identification of small DNA fragments synthesized in herpes simplex-infected cells in the presence of acyclovir. *Antimicrob Agents Chemother* 25: 507-509.
- Mohammed, A, S.B. Mada, A. Olagunju, A. Muhammad, S.M. Bala, A. Garba, A.M. Hafsat, S. Mustafa, H. Nasir Nakakana, H. Ahmadu, S. Aliyu (2012). Comparative in vitro antioxidant studies of ethanolic extracts of *Psidium guajava* stem bark and *Telfairia occidentalis* leaf. *Int. J. Modern Biochem.* 1 (1) 18-26
- Nishikimi, M; Rao, NA; Yagi, K (1972). The occurrence of superoxide anion in the reaction of reduced phenazine methosulfate and molecular oxygen. *Biochem. Biophys. Res. Commun.* 46: 849-854.
- Nubila, T; Ukaejiofo, OE; Nubila, IN; Shu, NB; Okwuosa, UC; Ukaejiofo, CA; Iyare, EE; Ogunka-Nnoka CU; Amagbe R; Amadi BA; Amadi PU (2017). Biochemical effects of *Telfairia occidentalis* leaf extracts against copper-induced oxidative stress and histopathological abnormalities. *J. Adv. Med. Pharm. Sci.* 12(2): 1-15.
- Ogbuta, OI. (2013). Effects of methanolic seed extract of *Telfairia occidentalis* on blood coagulation in Albino rats. *Nig. J. Exp. Clin. Biosci.* 1:10-13.
- Seyifunmi, OE (2023). Comparative Nephroprotective Effect of *Telfaria occidentalis* Leaf Extracts. *Int. J. Res. Pub. Rev.* 4 (9). 2562-2568
- Usunobun, U; Okpiabhele, A; Adegbegi. AJ (2023). *Telfairia Occidentalis* Hook f. Mitigates Carbon-Tetrachloride-Induced Nephrotoxicity in Wistar Rats. *NIPES – J. Sci. Technol. Res.*, 5(2). <https://doi.org/10.5281/zenodo.8010075>