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Original article

Effects of aqueous crude leaf extract of *senecio biafrae* on the histology of the frontal cortex, kidney, liver and testis of male sprague dawley rats

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ABSTRACT

Whenever any plant and/or herb is ingested, the body system interacts with it in an attempt to get rid of any harmful toxins such may contain, especially if the body cannot convert the foreign substance into useful components. This study was to evaluate the effects of oral consumption of aqueous leaf extract of *Senecio biafrae* on the histology of the frontal cortex, kidney, liver and testis of Sprague Dawley rats as a marker of toxicity. Twenty adult male Sprague Dawley rats weighing between 100-158 g were used (4-6 weeks old). They were divided into 2 groups. The rats in the treatment group A received 300 mg/kg body weight of the aqueous leaf extract of *S. biafrae* for thirty days (30d). Histological observation of the frontal cortex, liver, kidney and testes revealed no significant abnormal alterations. The rats in the control group B received equal volume of phosphate buffered saline (PBS) also for 30d and no histopathological abnormalities were seen in the frontal cortex, kidney, liver, and testes of the rats. Aqueous leaf extract of *S. biafrae* has no deleterious effects on the histological profile of the frontal cortex, liver, kidney and testis of the rats.

1. Introduction

Senecio biafrae is one of the green leafy vegetables consumed in Sierra Leone, Ghana, Benin, Nigeria, Cameroon and Gabon (Adebooye, 2004). They are especially popular in south-western Nigeria. Nigeria is recognized worldwide for its vast fauna and flora biodiversity, which can be explored in several ways (i.e. culinary, medicinal, therapeutic, nutritional, e.t.c.) for the benefit of mankind. Green leafy vegetables provide a source of vitamins, minerals and fiber for the local consumers. Due to their dietary importance, many scientific studies have been carried out on the potentials of these green leaves (Akindahunsi and Salawu, 2006).

Green leafy vegetables are popularly used for food in many countries of the world, being a rich source of ß-carotene, ascorbic acid, minerals and dietary fiber (Sun *et al.,* 2002; Oboh, 2005; Oboh and Akindahunsi, 2004; Oboh and Rocha, 2007). The potential of the Nigerian flora as a veritable source for pharmaceuticals and other therapeutic materials have been emphasized (Gbile and Adesina, 1986). Apart from healing, these leafy vegetables provide the necessary nutrients for health and development of the human body. In time past, the average African rural dweller depended on subsistence farming in which he cultivated vegetable crops at least for his immediate family consumption (Ayodele, 2005).

According to Famurewa (2010) and Dairo and Adanlawo (2007), the plant is documented to be very rich in protein and ascorbic acid. Several studies have documented the folklore medicinal properties of the plant (Akah, 1996; Viana *et al,* 2003; Gullice *et al,* 2004; Okpara *et al,* 2006; Fowomola and Akindahunsi, 2005), the chemical composition of the plant (Adeleke and Abiodun, 2010), the nutritional properties of the plant (Dairo and Adanlawo, 2007), the physicochemical properties of the plant (Famurewa, 2010), the antioxidant properties of the plant (Adefegha and Oboh, 2011).

The evaluation of natural products with biological activity require a proper and adequate study of such product(s) prior to use as it concerns the well-being of the users. The use of plant either for medicinal and/or nutritional properties are less damaging than synthetic drugs they have better compatibility thus improving patient tolerance even on long-term use (NCEP, 2002). Contrary to this, it is known that, whenever any plant and/or herb is ingested, the body system interacts with it in an attempt to get rid of any harmful toxins such may contain, most especially if the body cannot convert the foreign substance into useful components. These results into insults which are commonly manifested by changes in enzyme levels and alteration in the cellular make up of various affected organs. The toxicity could as well result in tissue or organ damage. The vital organs that are commonly affected are brain, liver, pancreas, and kidney among others (Dapar *et al,* 2007). The objective of this study therefore, was to investigate the effect of the *Senecio biafrae* on the histology of the frontal cortex, kidney, liver and testis of Sprague Dawley rats as a marker of toxicity.

2. Materials and methods

2.1. Collection of plant and preparation of plant extracts

Fresh green leaves of *Senecio biafrae* were harvested from the Botanical garden of the University of Ilorin, Ilorin, Nigeria. Identification of the plant was made at the Botany Department of the same University. The authenticated plant sample was air-dried at room temperature under standard laboratory procedures. The air-dried leaves were weighed using Gallenkamp (FA2104A, England) electronic weighing balance and were milled with automatic electrical Blender (model MS-223, China) to powdered form.

Three hundred and fifty-five grams of the milled plant sample was later soaked in 700 ml of PBS for 48 hours (Iweala and Okeke, 2005) at room temperature, and was later filtered through cheese cloth and then through Whatman #1 filter paper (Khan et al, 2010), the filtrate was concentrated using a rotary evaporator (Rotavapor® R-210) at 42- 47°C.

2.2. Laboratory animals and feeding

Twenty healthy male Sprague Dawley rats were randomly grouped into a treatment group A (n=10), and control group B (n=10).

The rats in the treatment group were administered orally with 300 mg per kilogram body weight of the aqueous leaf extract of *Senecio biafrae* for 30d.

The rats in the control group B received equal volume of PBS also for 30d.

All the rats were accommodated in clean cages of dimensions 33.0×20.5×19.0 cm situated in well ventilated standard housing conditions (temperature: 28–31^{o}C; humidity: 50–55%). All experimental procedures followed the

recommendations provided in the "Guide for the Care and Use of Laboratory Animals" prepared by the National Academy of Sciences and Published by the National Institute of Health (NIH, 1985). The rats were fed with standard rat chow at a recommended dose of 100 g/kg as advised by the International Centre of Diarrheal Disease Research, Bangladesh (ICDDR, B) daily. Drinking water was supplied *ad libitum*.

Twenty-four hours after the last administration, all the rats were sacrificed by cervical decapacitation, the frontal cortices, kidney, liver and testes were excised and blotted dry on a filter paper. The liver was fixed in specimen bottle containing 10% formol saline, the kidney and testes were fixed in separate specimen bottles containing Bouin's fluid, and the frontal cortices were fixed in specimen bottles containing 10% formol calcium, for histological studies.

2.3. Histological parameters

After fixing the frontal cortices, kidneys, liver and testes of both the treated and control rats, the tissues were processed and examined for light microscopy. The stain used was hematoxylin and eosin for the general cytoarchitecture of the respective tissues. The permanent photomicrographs of each slide was taken with a Nikon Digital Camera DXM1200F (Nikon, Japan) for subsequent histological analysis.

3. Results

The neurohistological assessment of the frontal cortices of the rats in the extract treated group displayed normal histological profile, degenerative changes such as cytoarchitectural distortions, vacuolations and evidence of necrotic bodies were absent in the frontal cortices of the extract treated rats. The sections obtained in the control group also conformed to normal histological features (fig. 1A and B). The histological outline of the kidney of the rats in the treated and control group appeared normal and preserved (fig. 2A and B). The sections of the liver of the rats in both the extract treated and the control groups also displayed well preserved histological profile. The liver is devoid of any histopathological alteration (fig. 3A and B). The histological section of the testes of the rats in both the extract treated and the control groups were also devoid of histopathological abnormalities (fig. 4A and B).

4. Discussion

The effects of aqueous leaf extract *Senecio biafrae* on the frontal cortex, kidney, liver and testes of rats have not been studied. In this study, we investigated some of the effects of the aqueous leaf extract of *Senecio biafrae* on these organs in order to elucidate some of the possible implications that could occur following its consumption. Using the Olympus binocular light microscope (XSZ-107BN, No. 071771), the histological observations seen in the sections of the frontal cortex, kidney, liver and testis of the experimental rats in the treated groups stained with H&E revealed that oral administration of the aqueous leaf extract of *Senecio biafrae* has no deleterious effects on the histological outline of frontal cortex, liver, kidney and testis as there were no histopathological alterations in the frontal cortex, liver, kidney and testis of the rats in the extract treated group when compared with the corresponding histological sections obtained from the rats in the control group. Similar report was made by Ofusori *et al.* (2008), Adekomi *et al* (2011a), Adekomi (2010) and Adekomi *et al,* (2011b). Cell death occurring pathologically or accidentally is regarded as necrotic and could result from extrinsic implications and/or disturbances to the cell and these may include toxic or traumatic effects (Ito *et al,* 2003). Processes involved in cellular necrosis which may lead to cell death include compromise and/or disruption of the structural and functional potentials of the various membranes in and within the cell. Necrosis of the cell is not induced by intrinsic stimuli to the cells as observed in programmed cell death, but by an abrupt environmental disturbances and deviation from the normal physiological conditions, factors and functions. The type of cell loss and the particular part of the organ affected determines the symptoms associated with individual disease (Waters, 1994). This investigation confirmed that oral administration of the aqueous leaf extract of *Senecio biafrae* has no toxic and disruptive interference on cellular characteristics of the frontal cortex, liver and testes of Sprague Dawley rats. To the best of our knowledge, this is the first study reporting the effect of *Senecio biafrae* on the histological profile of the selected organs of study in Sprague Dawley rats.

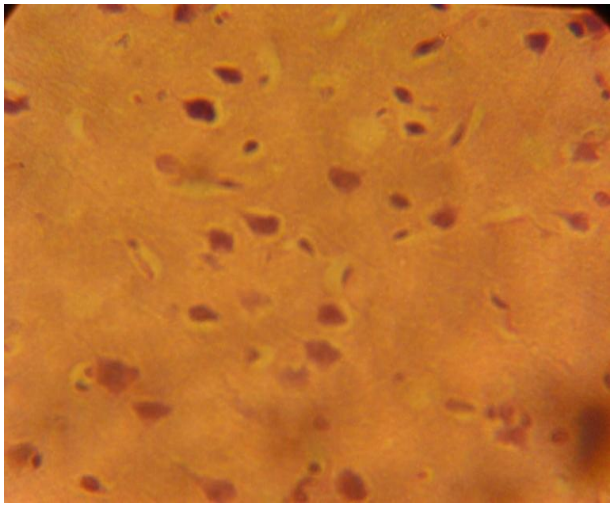


Fig. 1A. Photomicrograph of the frontal cortex of the rat in the control group conformed to normal histological features (H&E x400).

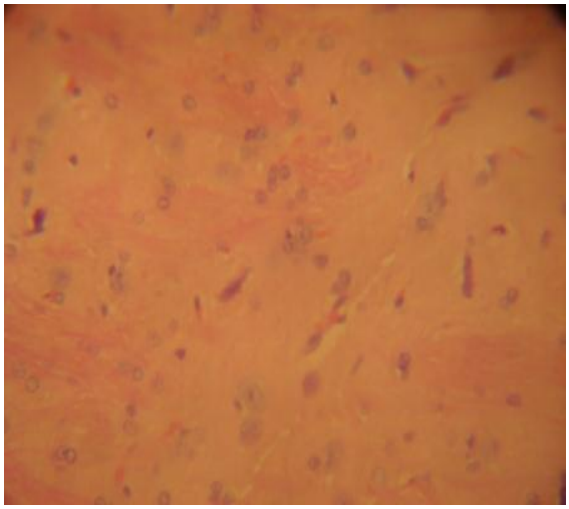


Fig. 1B. Photomicrograph of the frontal cortex of the rat in the treated group devoid of neurodegenerative changes (H&E x400).

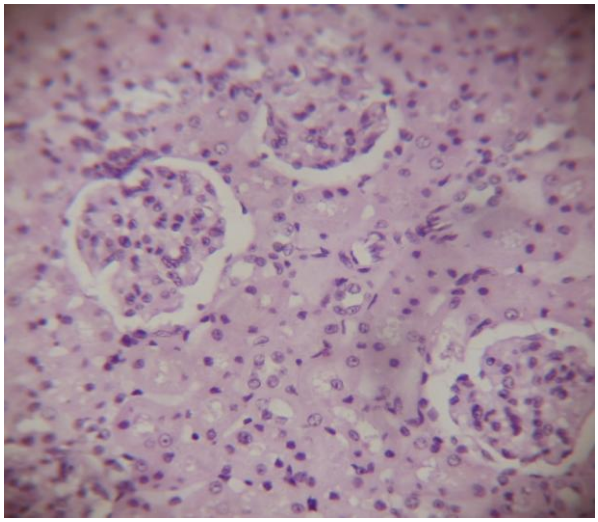


Fig. 2A. The kidney section of the rat in the control group with well preserved histological profile (H&E x480).

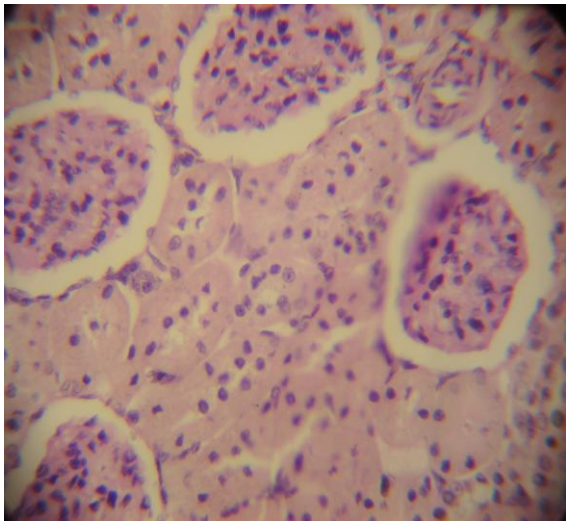


Fig. 2B. The kidney section of the rat in the treated group with no histological deviations (H&E x400).

5. Conclusion

In conclusion, data obtained from this study showed that the oral administration of aqueous leaf extract of *Senecio biafrae* has no deleterious effect on the cytoarchitecture of the frontal cortex, liver, kidney and testis of male Sprague Dawley rats. Further studies should be directed towards isolating the specific component(s) of the plant responsible for the toxicity in the kidney in order to standardize the plant preparation for maximum culinary and therapeutic benefits.

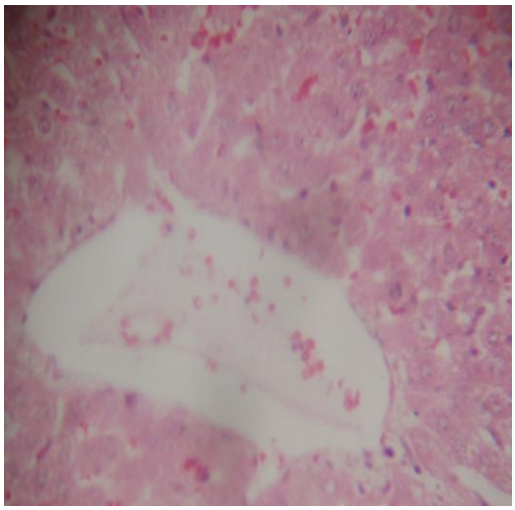


Fig. 3A. Histological section of the liver of the rat in the control group with well preserved histologigal profile devoid of histological alterations (H&E x400).

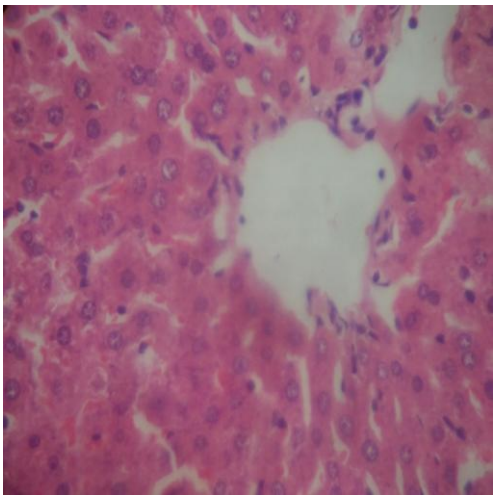
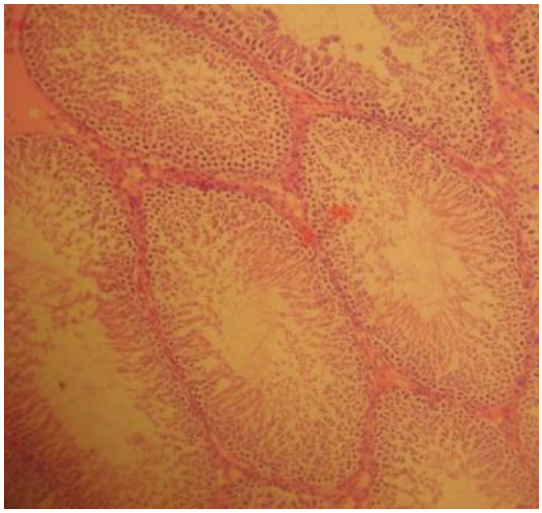
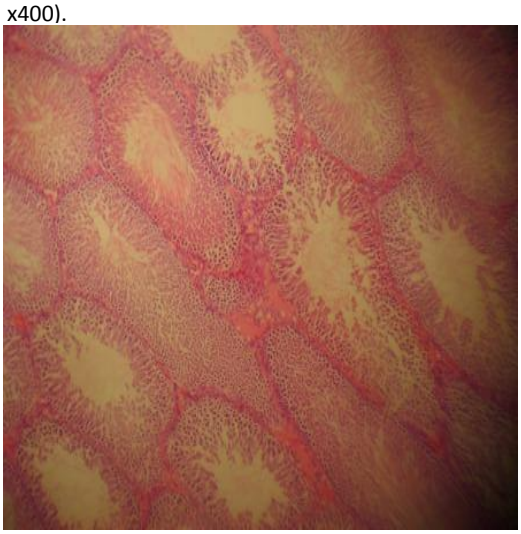


Fig. 3B. Histology of the liver of the rat in the treated group with well preserved histological outline devoid of degenerative changes (H&E x400).





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