

Full Length Research Paper

Evaluation of the Reproductive Toxicity and Thyroid Function of *Ipomoea batatas* Leaf Extract in Male Wistar Rats

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The effect of the leaf extract *Ipomoea batatas* was investigated on the thyroid gonadal axis of male rats. The leaf extract of *I. batatas* was extracted by dissolving a measured dry-powder leaf sample in a known volume of distilled water. The soaked plant sample was allowed to stand overnight for 24 h. The sample was filtered and the filtrate evaporated into solid extract. Three doses of the leaf extract of *I. batatas* (100, 200 and 300 mg/kg/d) were administered orally daily for three weeks. At the end of the treatment, the rats of all the groups were sacrificed and their thyroid glands and testes were isolated and fixed in Bouin's fluid for 48 h. The sections of the tissues were processed for histopathology. The results revealed follicles hypertrophy and hyperplasia as well as reduction of colloid in the lumen of the follicles. The photomicrograph of the testes morphology revealed oligospermia, asthenospermia and abnormal sperm morphology suggesting male contraceptive property of the plant extract. These effects were also confirmed by sperm count. The possible mechanism of action could be both direct on gonads and indirect via the hypothalamo-hypophyseal axis.

Key words: Thyroid, gonads, *Ipomoea batatas*, contraception, Wistar rats.

INTRODUCTION

The plant *Ipomoea batatas* belonging to the family convulvaceae is a crop plant commonly called sweet potato (Austin, 1998). It has been identified by Frank Apejaye of Botany Department, University of Calabar. The specimen was deposited in the Herbarium of the Department of Botany. It is a crop with a tasting tuberous root (Purseglove, 1991; Woolfe, 1992). The leaves are eaten as vegetable. The edible tuberous root is long and tapered with colour ranges from red, purple, brown to white. It is reported that, the leaves of *I. batatas* are rich in vitamins and minerals (Ishiguro et al., 2004). Their further study revealed that the leaves also contain anthocyanin and polyphenolic compound.

It has been reported that the photochemical possesses multifaceted action including antioxidation, antimutagenity, anti-inflammation, anticarcinogenesis and antifertility. The leaves are also used in the treatment of diabetes, hookworm, hemorrhagic and abscesses, while the tuber is used for the treatment of asthma (Islam, 2006).

There is no previous report of the biological activity of the plant extract on the thyroid-gonadal axis of male rats from literature review. Therefore, it was necessary to undertake this investigation.

MATERIALS AND METHODS

Collection of plant material

The leaves of *I. batatas* were collected from the vicinity of the University of Calabar. The leaf-samples were washed in tap-water to remove debris. The leaves were sun-dried for 48 h and later oven-dried at $40 \pm 1^\circ\text{C}$ for 8 h. The dried-leaves sample was ground into powder using an electrical grinder. The leaf-powder sample was extracted in distilled water.

Preparation of extract

A weighed quantity of the leaf-powder sample (100 g) was dissolved in 500 ml of cold distilled water. The solution of the plant sample was allowed to stand for 24 h. The aqueous extract solution was evaporated in vacuo at 40°C for 12 h using Rotary evaporator. The percentage yield of the extract was 65. About 1 g of leaf aqueous extract was dissolved in 10 ml of distilled water to produce a

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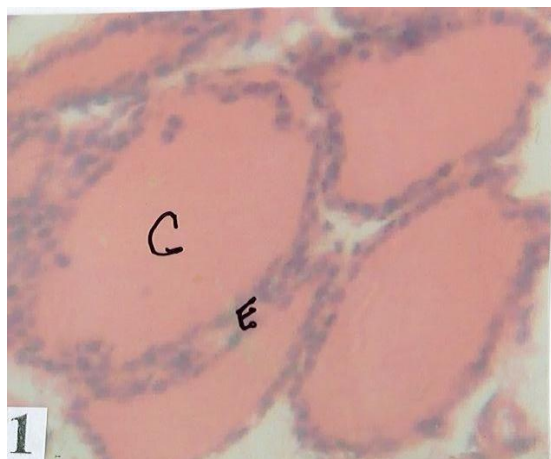


Figure 1. Cross sections of thyroid control showing normal histology: The follicles are lined with simple cuboidal epithelium (E) and lumen is filled with colloid (C) (x 200).

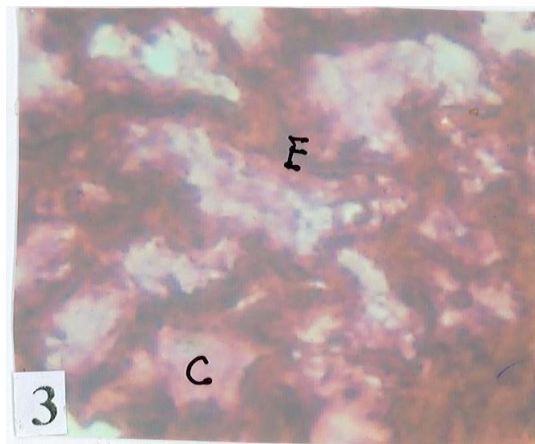


Figure 3. Cross sections of rats treated with 200 mg/bw extract showing marked reduction in colloid (C). Also marked hypertrophy and hyperplasia (H) (x 200).

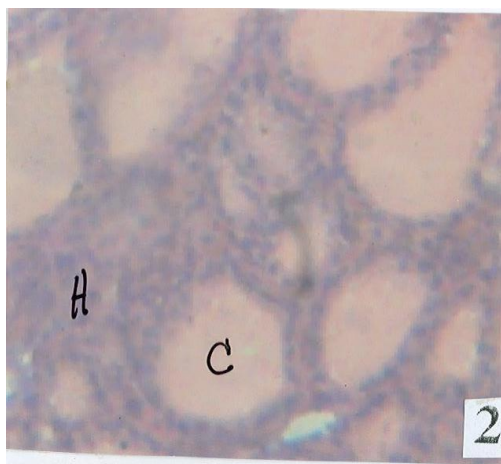


Figure 2. Cross sections of rats treated with 100 mg/bw extract showing thyroid with mild reduction in colloid, increased number of new follicles and hyperplasia (H) (x 400).

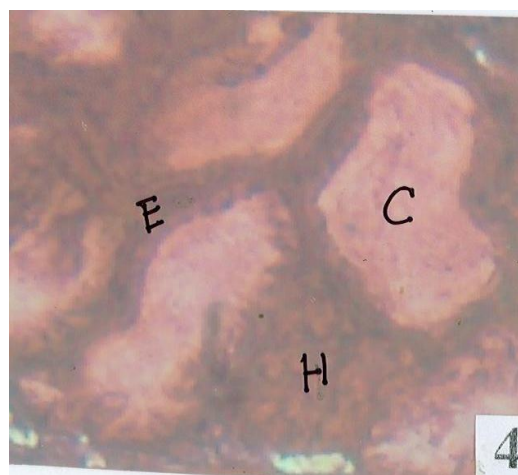


Figure 4. Cross sections of rats treated with 300 mg/bw extract showing severe hypertrophy and hyperplasia (H) decreased colloid, thickening of follicular epithelium (E) (x 200).

concentration of 500 mg/ml as stock extract solution.

Experimental design

Male rats were divided into 4 groups of 5 rats per group. Groups 1 - 3 received 100, 200 and 300 mg/kg and group 4 receive 0.2 ml of olive oil as control orally, daily for 4 days respectively. After 24 h of the last treatment rats of all groups were sacrificed by etherization. Thyroid glands and testes of rats of both controls and treated groups were isolated and fixed in Bouin's fluid for 48 h. Histopathology. The isolated tissues were processed for microtomy. Both thyroid and testes sections were dehydrated in the graded concentration of ethanol, cleared in xylene and infiltrated in molten paraffin wax.

The tissues were blocked in molten paraffin wax and sectioned into film at 5 - 10 microns thickness with a microtome.

The films were rehydrated by passing them through graded concentration of ethanol in descending order then through water before staining with haematoxylin and counter stained with eosin. The stained films were examined under light microscope and photomicrographs were taken.

RESULTS

Male rats treated with the aqueous extract of the leaf of *I. batatas* (100, 200 and 300 mg/kg) orally, daily for 4 days exhibited pathological effects in a dose related manner (Figures 1, 2, 3 and 4). The photomicrograph of the thyroid gland of rat treated with 100 mg/kg showed mild reduction in the colloid, increased number of new follicles

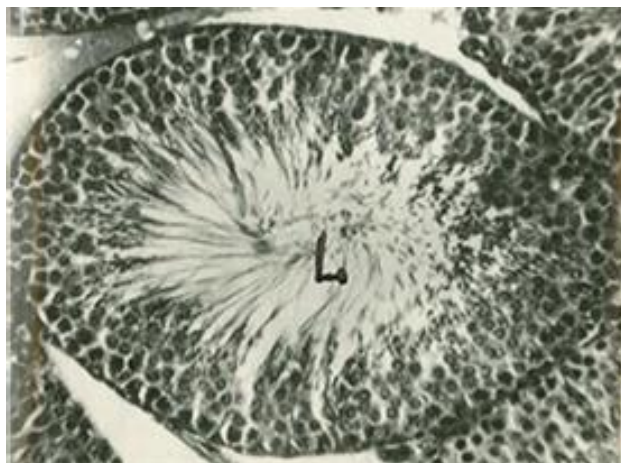


Figure 5. Cross sections of testes showing normal histology with lumen filled with sperm (L) (x 400).

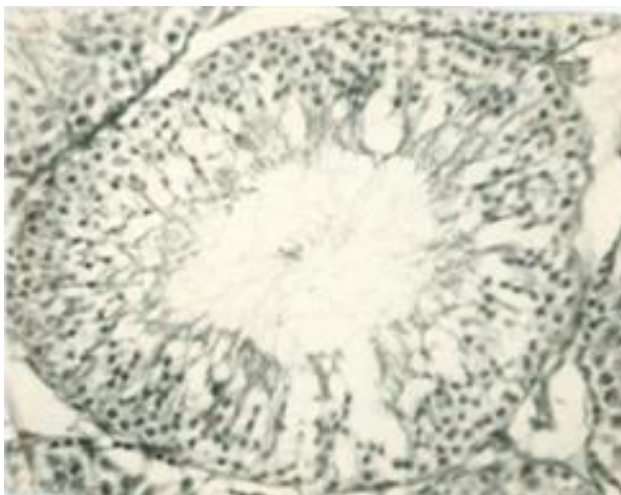


Figure 6. Cross sections of testes treated with 200 - 300 mg/bw showing spermatogenic arrest and degeneration of germ cell (x 400).

and hyperplasia (Figure 2).

Photomicrograph of the sections of the thyroid gland and testes from rats treated with 200 mg/kg revealed a marked reduction in the colloid in most of the follicles of the thyroid and degeneration of germ cells in the tubules and lumen of testes. There was also Leydig cells metaplasia (arrow) and reduction in number (Figures 5, 6 and 7). There was also marked hypertrophy and hyper-plasia of the thyroid cells (Figure 3).

The histopathology of the gland from rats pretreated with the 300 mg/kg *I. batatas* leaf extract revealed severe hypertrophy and hyperplasia in their photomicrographs (Figure 4). The morphology of the gland showed more numerous follicles compared with the control. The photomicrograph of the sections of thyroid gland of rats treated

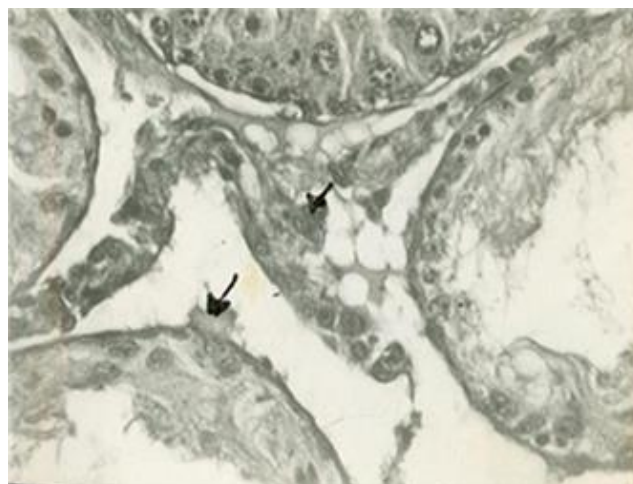


Figure 7. Cross sections of testes treated with 300 mg/bw showing interstitial cells of leydig with metaplasia (arrows) and reduction in number (x 400).

with this dose further revealed thickening of the follicular basement membrane with follicular cells becoming columnar in shape, decreased thyroglobulin and colloid (Figure 4).

DISCUSSION

The results of this study showed that the leaf of *I. batatas* pretreatment in male rats induced hypertrophy and hyperplasia in the morphology of the thyroid gland. These effects were dose related. These observations were similar to the previous results of effect of *Carica papaya* pretreatment on the morphology of thyroid gland (Udoh and Patil, 1992). The pathological changes observed in the morphology of the gland might result in hypothyroidism and malfunction of the thyroid gland. Hypothyroidism could result in pubertal delay. This pathology state of thyroid gland could lead to altered production of sex hormone binding globulin and sex hormone metabolic pathways and clearance rates (Knudson, 1995). The alteration in the physiology of the gland might influence negatively spermatogenesis and fertility in male rats (Krassas and Pontikides, 2004, Lohiya et al., 2008). Thyroidectomy inhibits spermatogenesis and development of Leydig cells (Udoh et al., 2005c). Since thyroidectomy could result in hypothyroidism and malfunction of the gland in the same manner with the effect of *I. batatas* pretreatments on thyroid gland. The findings allowed the suggestion that *I. batatas* could interfere with male reproductive functions.

The findings further revealed that hypertrophy and hyperplasia of thyroid gland might impair the secretion of thyroid hormones resulting in positive feed back activity of the hypothalamic-pituitary axis with respect to increased

release of thyroid hormone releasing hormone (THRH) to stimulate the release of thyroid stimulating hormone (TSH) (Stradtman, 1993; Woeber, 2000).

It would be interesting to speculate about the results of this study that the pathologic changes following the effects of *I. batatas* extract pretreatment could result in hypothyroidism leading to impaired sperm motility, oligospermia, asthenospermia and infertility in men.

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