Tackling Infertility With Medicinal Plant: Another Instance

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ABSTRACT

The present study therefore was designed to investigate the protective potentials of aqueous extract of Croton zambesicus (AECZ) on testicular toxicity induced by allethrin-based mosquito coil by evaluating testicular histomorphometry, spermatogenesis, steroidogenesis and oxidative status evidences in the rat testis. Thirty male Wistar rats (8 to 10 weeks old) weighing 250-280 g were where divided into three groups of ten rats each. The results obtained from this study showed a significant (P<0.005) decrease in the absolute and relative testicular weight of the models exposed to allethrin-based mosquito coil for 16 weeks compared to the control counterpart. This group (Mosquito coil-alone) demonstrated a reduction of basal seminiferous epithelial cells, marked testicular atrophy, germinal aplasia and hypop spermatogenesis formation. There was also a significant (P<0.005) decrease in the seminiferous tubule diameter (98.8±4.1 μm) and cross sectional area (16.33±6.1 μm²) and a significant (p<0.05) decrease in the sperm count (67.1±5.1) and motility (41.1±3.4%) but an increase in total abnormal sperm morphology (50.4±2.1%) when compared to the values of obtained from control (157.4±3.1 μm, 28.3±4.2 μm², 135.8±3.1, 93.1±4.5% and 9.5±2.1% respectively). Furthermore, there was a significant decrease (p<0.005) in testicular activities of superoxide dismutase, catalase, reduced glutathione, glutathione peroxidase and a significant (p<0.01) increase in level of malondialdehyde compared with the control values. All these parameters were however ameliorated in the groups that were post-treated with aqueous extract of Croton zambesicus together therefore, it was concluded that aqueous extract of Croton zambesicus play an attenuating role in dwindling of testicular derangement as a result of allethrin-based mosquito coil exposure.

Key words: Mosquito Coil, Allethrin, Infertility, Antioxidants, Croton zambesicus, Histo-morphometry

Introduction

Globally, infertility affects about 50 to 80 million couples at some point of their reproductive lives with a variety of biological and behavioral determinants (W.H.O. 2003). Various medicinal plants ranging from Quassia amara (Raji & Bolarinwa, 1997), Ruta graveolens (Khouri & El- Akawi, 2005), Terminalia catappa (Ratnasooriya & Dharmasiri, 2000), Ricinus communis (Raji et al., 2006), Vernonia amygdalina (Oyeyimi et al., 2008) and Ricinus communis have been implicated in male infertility. Fortunately, several countries in the world are gifted with plant biodiversity, and there is currently an emanating awareness about the significance of plant remedies in health care delivery system. In many parts of the world, efforts are now being aimed at investigating therapeutic efficacy of locally available medicinal herbal plants. The beneficial role of medicinal plants in the treatment of male infertility has been numerosely indicated (Saalu et al., 2006, 2009a, 2009b, 2010).

Croton zambesicus (Figure 1 and 2) is a shrub or small tree about to 16 m high. It is widely distributed in tropical Africa. It has a scaly bark and silvery leaves (Figure 2), rusty-scaly below, and has an attractive appearance (Adjanohoun et al., 1989). In western part of Nigeria (Yoruba) it is called àjé kó bálé (Okokon et al., 2006; Ofusori et al., 2008) and an infusion of the bark is used in cases of malaria (Boyom et al., 2002). Antimicrobial properties of the leaf and stem extracts of Croton zambesicus have been documented (Abo et al., 1999; Ofusori et al., 2007). The ethanolic leaf extract has been reported to possess antiplasmodial (Okokon et al., 2009a, 2005a), anti-inflammatory, analgesic and antipyretic activities (Okokon et al., 2005b), while the root extract has been reported to possess antimalarial (Okokon and Nwafor, 2009a) and anticonvulsant and antiulcer activities (Okokon and Nwafor, 209b).

There are several measures in reducing malaria incidence at the community level but for an individual, personal protection against mosquito bite is the first line of action. This includes the use of cost effective insecticides such as mosquito coil especially in developing nations such as Nigeria. The active component of mosquito coil is allethrin which account for about 0.3–0.4% of coil mass. All pesticides are toxic to humans (W.H.O.P.E.S, 1996) and symptoms such as nausea, dizziness and headache have been evident in male animals exposed to 0.01–1.98 μg/m3 allethrin for 0.5–5 hr (Cincinnati, 1986; Zhang et al., 2008b). Infertility and pesticide exposure has been correlated in numerous studies and many environmental xenobiotic chemicals, dioxin, insecticides, herbicides and some pesticides have been indicated to cause testicular degeneration (Sikka and Nigun, 2005). The toxic effect of allethrin has been vastly reported (Sittig, 1985; Liu and Sun, 1988; Liu...
and Wong, 1989) and due to rich polyunsaturated fatty acids membranous structures of the gonad it is considered the main target for environmental toxins (Sokol, 1997).

The present study therefore was designed to investigate the protective potentials of aqueous extract of *Croton zambesicus* (AECZ) on testicular toxicity induced by allethrin-based mosquito coil by evaluating testicular histomorphometry, spermatogenesis, steroidogenesis and oxidative status evidences in the rat testis.

Fig. 1: *Croton zambesicus* tree.

Fig. 2: *Croton zambesicus* leaf.

**Materials and Methods**

**Mosquito Coil:**

Mosquito coils containing 0.2% w/w of d-trans-allethrin, measured 12 cm diameter, 85 cm length and 15.3 g in weight were purchased from a local outlet located within Bariga, Lagos Nigeria.
Plant Source and Identification:

The fresh leaf of *Croton zambesicus* was purchased from Mile twelve local market in Lagos, Nigeria on 2nd of January, 2012. The authentication was carried out in the department of Botany, University of Lagos where a voucher specimen number was deposited in the herbarium Department.

Animals:

Thirty male Wistar rats (8 to 10 weeks old) weighing 250-280 g were obtained from the animal house of the Lagos state college of medicine. They were allowed to acclimatize for 2 weeks and were fed freely on standard commercial mouse cubes from Ladokun and sons livestock feed Limited, Ibadan. Relatively constant environmental condition were maintained with proper aeration and good source of light (12h light-12h dark and 24degree C ± 30degree C). Food and water were provided ad libitum. Experimental procedures involving the animals and their care were conducted in conformity with International, National and institutional guidelines for the care of laboratory animals in Biomedical Research and Use of Laboratory Animals in Biomedical Research as promulgated by the Canadian Council of Animal Care (CCAC, 1985). Further the animal experimental models used conformed to the guiding principles for research involving animals as recommended by the Declaration of Helsinki and the Guiding Principles in the Care and Use of Animals (American Physiological Society, 2002).

Extraction of Plant Material:

The aqueous extraction was prepared manually as described by Rashidat and Noe in 2008. The fresh leaves of the plant were shaded and dried for 8 days and then it was grounded into a powder using mortar and pestle. 100 g portion of the powder was macerated in 1000 ml of distilled water for 24 hours and then boiled for 15 minutes before it was allowed to cool. Then it was centrifuged at 4000 r.p.m at 4°C for 20 minutes. After which, the supernatant part was evaporated to dryness (Rashidat and Noe, 2008). The dry extract (13.90 g) was stored in a refrigerator at 4°C and used subsequently for the proposed experiment.

Dose Selection:

The volumes of aqueous extract of *Croton zambesicus* (CZ) given to the animals was determined by the formula stated below:

\[
\text{Volume of AECZ (ml)} = \frac{\text{weight of animal (kg) \times dosage of AECZ (mg/kg)}}{\text{Concentration of the AECZ (mg/ml)}}
\]

The weight of each animal was determined shortly before treatment.

A single dose of *Croton zambesicus* leaf extract was used in this study: 200 mg/kg body weight (Okokon et al., 2006).

The concentration of AECZ in distilled water was 5 mg/ml as 500 mg of the extract was dissolved in 100 ml of distilled water.

Animal Groupings and Mosquito Coil Exposure:

The study was conducted in three (A, B and C) undisturbed cages of size 5 m³ with cross ventilation (Garba et al., 2008). The rats in group A served as the control group and were treated orally with 2.5 ml/kg body weight/daily of distilled water for 16 weeks (Saalu et al., 2010). The rats in group B was exposed via whole body inhalation to the commercially available mosquito coil smoke for 8 hours (7am-3pm) everyday for 16 weeks consecutively (Garba et al., 2008). The rats in group C was exposed to mosquito coil smoke via whole body inhalation for 8 hours (7am-3pm) and subsequently treated with 200 mg /kg body weight of aqueous extract of *Croton zambesicus* for 16 weeks consecutively (Okokon et al., 2006).

Animal Sacrifice and Sample Collection:

The rats were at the time of sacrifice first weighed and then anaesthesized by placing them in a closed jar containing cotton wool soaked in chloroform. The abdominal cavity was opened up through a midline abdominal incision to expose the reproductive organs. Then the testes and epididymes were excised. The weight of the testes of each animal was evaluated .The testes were weighed with an electronic analytical and precision balance (BA 210S, d=0.0001- Sartoriusen GA, Goettingen, Germany). The volume of each testis was measured by water displacement method. The two testes of each rat were measured and the average value obtained for
each of the two parameters was regarded as one observation.

One of the testes of each animal was fixed in 10% formol-saline for histological examination. Serum and the remaining testes of each animal were stored at – 25°C for biochemical assays.

**Epididymal Sperm Characteristics:**

As described by Akunna et al. (2012), the testes from each rat were carefully exposed and removed. They were trimmed free of the epididymides and adjoining tissues. From each separated epididymis, the cauda part was removed and placed in a beaker containing 1 mL physiological saline solution. Each section was quickly macerated with a pair of sharp scissors and left for a few minutes to release its spermatozoa into the saline solution. Sperm motility, concentration and progressive motility were determined as earlier described Saalu et al., 2006. Semen drops were placed on the slide and two drops of warm 2.9% sodium citrate were added. The slide was covered with a cover slip and examined under the microscope using X40 objective for sperm motility. Sperm count was done under the microscope using improved Neubauer haemocytometer.

**Histological Analysis:**

This was done as essentially as described by Saalu et al., (2008). The organs were cut in slabs of about 0.5 cm thick and fixed in Bouin’s fluid for a day after which it was transferred to 70% alcohol for dehydration. The tissues were passed through 90% alcohol and chloroform for different durations before they were transferred into two changes of molten paraffin wax for 20 min each in an oven at 57°C. Serial sections of 5 μm thick were obtained from a solid block of tissue and were stained with haematoxylin and eosin stains, after which they were passed through a mixture of equal concentration of xylene and alcohol. Following clearance in xylene, the tissues were oven–dried. Light microscopy was used for the evaluations.

**Stereological Evaluations:**

Histological slides were prepared from the formol-saline fixed testes. However, before embedding, it was ensured that the sections were orientated perpendicular to their long axes, and chosen as “vertical sections”. For each testis, five vertical sections from the polar and the equatorial regions were sampled (Qin and Lung, 2002) and an unbiased numerical estimation of the following morphometric parameters was estimated using a systematic random scheme (Gundersen and Jenson, 1987):

- **Diameter (D) of seminiferous tubules:**
  The diameter of seminiferous tubules with profiles that were round or nearly round were estimated for each animal and a mean, \( \bar{D} \), was determined by taking the average of two diameters, \( D_1 \) and \( D_2 \) (Perpendicular to one another). \( D_1 \) and \( D_2 \) were taken no more than when \( D_1/D_2 \geq 0.85 \).

- **Cross-sectional area (AC) of the seminiferous tubules:**
  The cross-sectional areas of the seminiferous tubules was estimated from the formula \( AC = \pi D^2/4 \), (where \( \pi \) is equivalent to 3.142 and \( D \) the mean diameter of the seminiferous tubules).

- **Number of profiles of seminiferous tubules in a unit area of testis (NA):**
  The Number of profiles of seminiferous tubules per unit area was determined using the unbiased counting frame anticipated by Gundersen (1977). Using this frame, in addition to counting profiles completely inside the frame we counted all profiles with any part inside the frame provided they do not intersect the forbidden line (fulldrawn line) or exclusion edges or their extension.

- **Numerical Density (NV) of seminiferous tubules:**
  This is the number of profiles per unit volume and was determined by using the modified Floderus equation: \( NV = NA/ (D + T) \) (Gilliland et al., 2001) where, \( NA \) is the number of profiles per unit area, \( D \) is the diameter and \( T \) the average thickness of the section.

  The evaluation of the diameter was done with calibrated eyepiece and stage grids mounted on a light research microscope. Estimation of volume density of testicular components and number of seminiferous tubules were done on a computer monitor onto whom a graph sheet was superimposed and on which slides were projected from a research light microscope (Model N -400ME, CEL-TECH Diagnostics, Hamburg, Germany).
Determination of Biochemical Parameters:

Catalase activity (CAT) was estimated using the method of Aebi, 1983 as described by Saalu et al., 2006. Superoxide dismutase activity (SOD) was measured according to the method of Winterbourn et al., 1975. Plasma testosterone (TT) was determined using the method described by Saalu et al., 2009a. Glutathione (GSH) was determined by the method of Ellman, 1958 as described by Saalu et al., 2009b. Lipid peroxidation (LPO) in the testicular tissue was estimated colorimetrically by thiobarbituric acid reactive substances TBARS method of Buege and Aust, 1978. A principle component of TBARS being malondialdehyde (MDA), a product of lipid peroxidation. Glutathione peroxidase activity (GPx) was measured by the method described by Rotruck et al., 1973.

Statistical Analysis:

The data were statistically analyzed and expressed as Mean ± SD. Analysis was carried out using analysis of variance (ANOVA) with Scheffe’s post hoc test. The level of significance was considered at $p < 0.05$.

Results:

Body Weight, Testes Weights and Volume:

Figure 3 shows that animals in Group A had a significant ($p<0.05$) enhancement in body weight when compared to rats in other groups. Group B rats loss body weight significantly ($p<0.005$) when compared to their initial weight while Group C rats lost body weights ($P<0.05$) when compared with their original weights.

There was a significant ($p < 0.01$) decrease in the testis weight, testis weight/body weight ratio and testis volume in the group exposed to the mosquito coil when compared to the control group. However, the group exposed for 14 hours had a more significant reduction their weight (Figure 4).

Fig. 3: Showing the weight differences of both the control and experimental group.

** P < 0.005 significantly different from control. Values are expressed as mean ± SD for n=10 in each group.

Epididymal Sperm Characteristics:

As shown in Table I, the group that was exposed to allethrin-based mosquito coil had marked oligospermia (67.1±5.1) with their sperm concentration being significantly lower ($P<0.005$) compared to the control models (135.8±3.1) The exposed group treated with AECZ however, showed moderate ($P<0.05$) oligospermia (115.1±5.1) which are comparable to that of the control.

Spermatozoa motility, progressivity and morphology:

The percentage sperm motility of the treated group were significantly ($P<0.005$) higher (82.3±8.1) compared to the untreated model group (41.1±3.4) and comparable with that of the control value (93.1±4.5).
The results of the sperm progressivity and morphology followed the same pattern as that of the sperm count and motility.

**Fig. 4:** Showing the Testicular Weight, Volume and Testis Weight/body weight Differences.

* P < 0.05; ** P < 0.005 significantly different from control. Values are expressed as mean ± SD for n=10 in each group.

<table>
<thead>
<tr>
<th>Treatment Groups</th>
<th>Sperm Count (X106/Ml)</th>
<th>Sperm Motility (%)</th>
<th>Progressivity</th>
<th>Morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>135.8±3.1</td>
<td>93.1±4.5</td>
<td>a1</td>
<td>95.3±2.1</td>
</tr>
<tr>
<td>Mosquito Coil</td>
<td>67.1±5.1**</td>
<td>41.1±3.4**</td>
<td>b1</td>
<td>36.5±6.1**</td>
</tr>
<tr>
<td>Mosquito Coil +AECZ</td>
<td>115.1±5.1*</td>
<td>41.1±3.4**</td>
<td>a1</td>
<td>77.2±0.1*</td>
</tr>
</tbody>
</table>

*, ** represent significant decreases and increases at P < 0.05 and P < 0.005 respectively when compared to the control values. Values are means ± S.E.M. n = 10 in each group.

In this study, a spermatozoon was considered abnormal morphologically if it had one or more of the following features: rudimentary tail, round head and detached head.

**Table 1:** Showing the Sperm Characteristics of the Models.

Testis Morphology:

The cross-sections of the seminiferous tubules of control rats were fairly circular in outline with normal seminiferous epithelium and numerous spermatozoa within their lumen (Figure 5). Rats that were exposed to mosquito coil alone showed destructive changes in their seminiferous tubules and interstitial tissues. This group of animals demonstrated marked testicular atrophy and interstitial vacoulation (Figure 6). This contrasted significantly with the testicular profiles of the group of animals that were given AECZ post exposure to mosquito coil as these animals showed testicular features that approximated those of the control animals (Figure 5).

Testicular Geometry:

Figure 8 showed a significant (P<0.005) reduction in the mean seminiferous tubular diameters, cross-sectional area, number of profiles per unit area and the mean numerical density of seminiferous tubules of the exposed mosquito coil group without treatment compared to the control groups. However, there was a significant (P<0.005) increase in the tubular diameter of animals treated with AECZ as compared to tubular diameter of the control groups. There were significant (P<0.005) increase in the cross-sectional area of the tubules, the number of tubular profiles per unit area and the mean numerical density of seminiferous tubules of the models treated with AECZ which are comparable with that of the control value.
Fig. 5: The testis of control rats. The seminiferous tubules are completely differentiated, spermatozoa shown in some of the tubules H & E (X400).

Fig. 6: Testis of rat exposed to mosquito coil without treatment. Marked degeneration of the germinal epithelium, absence of late stage germ cells and vacoulation of the interstitium. H & E (X400).
Fig. 7: Testis of mosquito coil exposed group post treated with AECZ. Atrophied seminiferous and presence of some late stage germ cells in some tubules. Left H & E (X400).

Fig. 8: Showing seminiferous tubular diameter (μm), cross sectional area \( A_c (\times 10^3 \mu m^2) \), numerical densities of seminiferous tubules \( N_A (\times 10^8 \mu m^{-2}) \) and number of profiles per unit area \( N_v (\times 10^{10} \mu m^{-3}) \) in experimental and control models.

* \( P < 0.05 \); ** \( P < 0.005 \) significantly different from control. Values are expressed as mean ± SD for \( n=10 \) in each group.

**Testicular Oxidative Stress:**

**Activities of testicular enzymes SOD, CAT and GPx:**

As shown in Table 2, the group of rat exposed to mosquito coil had a significant decrease in SOD, CAT activity level when compared to control counterpart. The group that had AECZ post treatment showed a
significantly increase in testicular SOD activity which is comparable to the control values. The testicular activities of CAT after AECZ treatment were similar to that of the control values. The GPx activity of the rat treated with AECZ approximated ($P<0.05$) that of the control groups. The group that was exposed only to mosquito coil however, had a markedly decreased GPx activity compared to that of control values.

**Testicular Content of Malondialdehyde (MDA):**

The rat that were exposed to mosquito coil had a significantly ($P<0.005$) elevated testicular MDA as compared to the control value. Administration of AECZ caused a remarkable reduction in the testicular MDA level compared to rats in Group B.

**Table 2:** Showing results for antioxidative evaluation.

<table>
<thead>
<tr>
<th>Treatment Groups</th>
<th>SOD (u/mg protein)</th>
<th>CAT (u/mg protein)</th>
<th>MDA (nmol/mg protein)</th>
<th>GPx (nmol/mg protein)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7.5±2.2</td>
<td>391.3±6.2</td>
<td>22.5±5.3</td>
<td>0.85±2.1</td>
</tr>
<tr>
<td>Mosquito Coil</td>
<td>4.11±7.1*</td>
<td>358.2±4.5*</td>
<td>55.3±1.2*</td>
<td>0.32±6.1**</td>
</tr>
<tr>
<td>Mosquito Coil+ AECZ</td>
<td>6.51±2.5*</td>
<td>378.5±1.4*</td>
<td>30.2±4.1*</td>
<td>0.68±0.1*</td>
</tr>
</tbody>
</table>

*, ** represent significant decreases and increases at $P<0.05$ and $P<0.005$ respectively when compared to the control values. Values are means ± S.E.M. n = 10 in each group.

**Fig. 9:** Testicular Content of Malondialdehyde (MDA).

**P < 0.005** significantly different from control. Values are expressed as mean ± SD for n=10 in each group.

**Discussion:**

The present study was intended to estimate the protective potential of aqueous extract of *Croton zambesicus* as an antioxidant-rich nutraceutical on testicular toxicity induced by allethrin based Mosquitio coil. It went further to ascertain, the extent of allethrin-induced testicular damage.

It is paramount to be acquainted with the fact that accurate morphometric information may not only provide answers to important questions about the spermatogenic process but may also correlate with physiological and biochemical findings, leading to a complete understanding of infertility. As shown in Figure 8, the mean seminiferous tubular diameters, cross-sectional area of the tubules, the number of tubular profiles per unit area and the mean numerical density of seminiferous tubules of rat exposed to mosquito coil without treatment were significantly reduced. This agrees with previous documentation (Ezeasor, 1990) who providing well documented evidences of testicular morphologic and morphometric impairment following allethrin-induced toxicity. (Alhazza and Bashandy, 1998) reported swollen fibrocytes in the testes of rats treated with permethrin while (Sakr and Azeb, 2001) reported that with pyrethroid treatment, seminiferous tubules became hyalinized and thickened with deformed and poorly developed Leydig cells during the study. Deformed Leydig cells were also reported by (Alhazza and Bashandy, 1998) due to the pyrethroid inhalation in rats. Evidenced in this study, was a significant ($P<0.05$) increase in the tubular diameter, profiles per unit area, cross-sectional area and the mean numerical density of seminiferous tubules of group treated with AECZ and Mosquito coil as compared control groups.

Reactive oxygen species are produced by normal aerobic circle at a minimal concentration. Nevertheless, increased levels of oxidative stress and failure of inbuilt antioxidant defense system can result to death of a cell. Studies have shown that allethrin induces toxicity via oxidative stress by generation of free radical and reactive oxygen species (ROS), together with alteration of enzymatic antioxidative systems such as glutathione redox system (Sanvidhan et al., 2006, Mathur, 2008). For oxidative damage to occur, molecular oxygen is reduced to...
superoxide anion (O2•−), which is converted to other forms of reactive oxygen species such as hydrogenperoxide (H2O2) and the more toxic hydroxyl free radical (OH•) causing membrane and macromolecule damage by lipid peroxidation, DNA fragmentation and protein oxidation (Pacher, 2007). Although the unusual structure of sperm membrane helps for its flexibility and the functional ability of spermatozoa, it is a common knowledge that this unusual nature explains the high risk of being attacked by lipid peroxidation as they present highly specific lipidic composition with high content of polyunsaturated fatty acids (PUFA), plasmalogens and sphingomyelins. This may explain why the testicular oxidative status of rats that received MC alone was severely deranged as evidenced by the significant (p < 0.01) decrease in the activities of SOD, CAT and GPx; in addition to the significant (p < 0.01) reduction in the GSH level as well as the significantly (p < 0.01) enhanced lipid peroxidation measured as MDA. However, treatment with AECZ ameliorated this derangement and this is evidenced by moderation of antioxidative biochemical markers. AECZ could have attenuated the ALT-induced toxicity via a reduction in free radicals dependent lipid peroxidation (Saalu et al., 2008, 2010). In 1994, Faizi et al, 1994 reported that enhancing the antioxidant system levels can favour reproductive potentials.

In agreement with the report of (Garba et al., 2007) and (Ahmed et al., 2010) involving mosquito coil exposure to animal models, the findings from this study showed a significant (p < 0.01) decrease in the testis weight, testis weight/body weight ratio and testis volume in rats exposed to only mosquito coil when compared to the controls and the groups that had AECZ post-exposure.

Pyrethroid exposure in various animals has been reported to decrease sperm parameters (Kamijima et al., 2004; Perry et al., 2007). A significant decline in sperm characteristic was indicated in the group of rat that was exposed to Mosquito Coil without post treatment with AECZ. Our result is in agreement with several other reports (Friedmann et al., 2002; Schrader et al., 2003; Farombi et al., 2008). Treatment with AECZ post mosquito coil exposure averted the derangement in sperm parameters with the values comparable to that of the control. This could be as a result of the antioxidative properties of Croton zambesicus as shown in previous reports (Abo et al., 1999, Okokon et al., 2005, Okokon et al., 2005b).

Vacuolization of the interstitium and hypospermatozoa formation in the seminiferous tubules of rats exposed to mosquito coil alone showed clear degenerative changes characterized by lumen devoid of spermatozoa. The histological evidences herein this study is consistent with several other reports on male infertility (Saalu et al., 2006, 2010). Gill et al. (2011) explored toxic effects of cypermethrin on bovine CLs in vitro, which included vacuolation, necrosis and significantly decreased viable cell counts. Testes in pyrethroid treated animals were reported to be atrophied and have islands of haemorrhage at areas surrounding seminiferous tubules indicated by the presence of red blood cells in the interstitial tissue (Elbetieha et al., 2001). Reduced or degenerated seminiferous tubules (Elbetieha et al., 2001; Zhang et al., 2007) with fibrosis (Elbetieha et al., 2001; Sakr and Azeb, 2001) have been documented in testes of pyrethroids treated animals. The ultimate explanation for the degenerative changes evidence in this study could be as a result of increased oxidative stress and cellular toxicity. The group of rat treated with AECZ post exposure to mosquito coil had a normal epithelia outline with intact interstitium indicating its role as an antioxidant as earlier reported.

Due to the quantity of spermatogenic cells in the basal layer and the Sertoli-Sertoli cell barrier which determines the number of cells in the adluminal compartment, we would be unable to conclude based on the histo-morphometric alterations in the present study. However, the oxidative evaluation in our study is a sound indication of the characteristics of testicular toxicity induced by allethrin-based mosquito coil with and without treatment with aqueous extract of Croton zambesicus.

Conclusion:

To the best of our knowledge and in accordance with similar works, this study may have provided the first documented evidence of the protective efficacy of Croton zambesicus on allethrin-induced testicular toxicity. Here in this study, it was also shown that allethrin-based mosquito coil induces testicular toxicity in rat via oxidative pathway based on the oxidative status evaluation.

References


