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Effect of Ethanolic Extract of *Xylopia aethiopica* on Cadmium Chloride Induced Toxicity on Testicular Tissues in Adult Male Wistar Rats

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Abstract

Medicinal plant extracts with a therapeutic property has the tendency of wrong prescription and sometimes, overdosed. The fact that *Xylopia aethiopica* is a natural product does not automatically confer on its safety and might be risky to its consumers. *Xylopia aethiopica* fruit is known to have alkaloids, terpenoids, flavonoids, and organic oils. This study was carried out to assess the effect of ethanolic seed extract of *Xylopia aethiopica* on cadmium chloride induced toxicity on testicular tissues in adult male wisiar rat. Twenty (20) male albino wistar rats were used for this study- The animals were randomly divided into five groups with each containing four adults male wistar rats. The experiment lasted for 14 days. Group 1 received distilled water and feed, group 2 was treated with 2m°/body weight of Cadmium, group 3 was treated with 2mg/body weight of Cadmium plus 50mg body weight of ethanolic seed extract of Xylopia aethiopica, group 4 was treated with 2mg/body weight of Cadmium plus l00mg/body weight of ethanolic seed extract of Xylopia aethiopica, group 5 was treated with l00mg/ body weight of ethanolic seed extract of Xylopia aethiopica. After 14 days of administration, the rats were sacrificed and the testes harvested, processed and stained with hematoxylin and eosin (H&E) staining method. Blood samples were collected in EDTA bottles for hormonal analysis Histological findings from this study revealed that cadmium chloride have severe toxic effects on the histology of the testes. Some of the effects include; Sertoli cells degeneration seen along with spermatids, primary spermatocytes and secondary spermatocytes degeneration. There were also interstitial cellular lesions of Leydig cells. These results revealed that consumption of high dose of *Xylopia aethiopica* has ameliorative effect on cadmium chloride toxicity.

Keywords: *Xylopia aethiopica*, Cadmium, ethanolic seed extract, Blood samples, wistar rat, testes.

INTRODUCTION

Infertility is an imperative component of reproductive health, and has often been omitted in many reproductive discourses (Cui, 2010). Infertility refers to a situation where a couple fails to achieve a pregnancy during the fertile phase of the menstrual cycle even after having regular and unprotected sexual intercourse for one year (Nieschlag *et al.,* 2000; Evers, 2002). Previous studies have revealed that infertility has affected about 15% of the couples who had sought for clinical treatment in order to have children in Africa (Feng, 2003; Roberts, 1998). The Male factor contributes to half of infertility cases worldwide (Agarwal *et al.,* 2014).

Evidence shows that many couples seek medical help to solve infertility issue (Ikechebelu *et al.,* 2003). Medical evidence indicates that around 80 % of Africans rely on conventional healthcare practitioners however others seek alternative medicinal flowers for their daily healthcare needs (Johnson, 2007; McKay and Blumberg, 2007). The natural products have reduced ache, suffering and revolutionized practice of medicine. In regard of this, more than 60% of approved and pre-new drug utility applicants are either natural products or associated with them in view of solving infertility problems (Demain, 1999). Studies on conventional medicinal plants have suggested that their potential to improve male fertility is partially because of presence of antioxidants, which appear to enhance several

processes/stages of steroidogenesis & spermatogenesis (Nantia *et al.,* 2009). A number of plant formulations have been reported to treat idiopathic infertility (Rama Devi *et al.,* 2016; Tempest *et al.,* 2008). It has been discovered that sperm quality is more important than sperm numbers (Anerao *et al.,* 2010). Spermatozoa's reduced viability has been linked to poor motility (Dhar *et al.,* 1968; Savita and Huma, 2010). Furthermore, spermatozoa with well-functioning mitochondria have a strong correlation with the proportion of live sperm (Magistrini *et al.,* 1997; Papaioannou *et al.,* 1997).

Xylopia aethiopica Dunal (Annonaceae) is an aromatic plant commonly known as "African pepper", "Ethiopia or Negro pepper". It has been used in Europe, Asia, and Africa as a pepper substitute and spice in local cooking. In Nigeria, the common local names used in different languages to refer to this plant are: "Kimba" in Hausa, "Eeru" in Yoruba, and "Uda" in Igbo (Abolaji *et al.,* 2007).

Human exposure to cadmium chloride, an endocrine disruptor with negative effects on the female reproductive system, typically occurs through inhalation and consumption of contaminated items (Ansa *et al*., 2017). Cadmium chloride is released into the environment from several industrial sources, posing a concern to both human and animal health as well as the ecosystem (Orisakwe, 2014). Blood, saliva, urine, and organ analyses can be used to determine the amount of cadmium chloride in humans. While urine analysis accurately detects both recent and previous exposures to cadmium, blood analysis only detects recent exposures (Jin *et al*., 2002). Multiple organs, including the kidneys, muscles, liver, reproductive system, lungs, and cardiovascular system, can be affected by cadmium chloride toxicity (Dix-Cooper & Kosatsky, 2018)

Male infertility is usually accompanied with a lot of stigmatizations all over the world. Male infertility in humans accounts for 40-50% of infertility problems and affects 7% of all men. While there has been an increase in male infertility since the mid-1970s, a lot of studies has pointed to the relationship between infertility and emasculation (Moyo & Stanzia,2013; Inhorn & Marcia, 2004.

Xylopia aethiopica is a widely used medicinal plant across Africa in traditional medicine for treatment of sexual dysfunction, yet very minimal scientific evidence exists to support the therapeutic claims.

MATERIALS AND METHOD

Animals:

Twenty-five (25) male wistar rats were used in this study. They were purchased from the Rivers State University, Port Harcourt, Nigeria and were allowed to acclimatize for fourteen days prior to the start of the treatment at the laboratory environment with 12 hours light and dark cycles. All animals were handled according to the International Guidelines for handling experimental animals (APS, 2022)

Cadmium:

Cadmium chloride was obtained from the chemistry department of Rivers State University, Port Harcourt, Nigeria. Before administration, cadmium was first dissolved in distilled water at a dose of 2mg/kg body weight and administered once daily. LD50 of the cadmium was predetermined as 2330mg/kg body weight.

Plant material:

Xylopia aethiopica seeds were purchased at Mile 3 market, Port Harcourt. They were dried under the sun and later grinded into a coarse powder form. 600g from the coarse form were weighed out and extracted with 1000ml of ethanol using extraction maceration for 24 hours in air tight container. All measurements were done using automated weighing machine. The LD50 of the extract was predetermined as 300mg/kg body weight.

METHOD

Experimental location

The investigation was carried out in the animal house of the department of human anatomy in River's state university, Port Harcourt.

Experimental Design

Group 1- control animals received only distilled water orally.
Group 2- Animals given oral doses of 2 mg/kg body weight of cadmium chloride.
Group 3- Animals treated with 2 mg/kg body weight of cadmium chloride plus 50mg/kg body weight of *Xylopia aethiopica* extract orally.
Group 4- Animals treated with 2 mg/kg body weight of cadmium chloride plus 100mg/kg body weight of *Xylopia aethiopica* extract orally.
Group 5- Animals treated with 100 mg/kg body weight of *Xylopia aethiopica* extract only.

The treatment was done once daily for 14 days. The rats were housed in a metal basket cage at room temperature and had access to commercial standard rodent pellets and cool clean water ad libitum. The cages and the animal house were constantly cleaned, feces and water changed about three times daily so as to maintain proper hygiene. The experiments were conducted according to the institutional animal care protocols at the Rivers State University Nigeria and followed approved guidelines and ethics for the treatment of Laboratory animals. The route of administration of the extract was via oral route with the aid of oral intubation tube. The body weight of the rats was measured just before administration, after 7 days of administration and after 14 days of administration.

Termination/Sacrifice/Organ Collection

Twenty-four (24) hours after the last administration, the rats were sacrificed using the chloroform inhalation method. The rats were starved for 24 hours to empty their bowels and stabilize the levels of biomarkers before sacrifice. Two from each group were sacrificed. They were each anaesthetized in a desiccator which contained cotton wool that was soaked in chloroform. The rats were each taken out of the desiccator when they appeared to be weakened by the chloroform and not completely dead in order to enable blood collection. Blood samples from each rat were taken via cardiac puncture into lithium heparin sample bottles. The testes were harvested and preserved using 10% formal saline and formalin solutions with the containers well labelled. The tissues were grossed and placed in tissue cassettes for further analysis.

Semen Analysis

This involved the removal of the caudal part of the epididymis and placing it in a beaker containing 1 ml physiological saline solution and allowing it to stand for few minutes to allow for the swimming of spermatozoa out of the solution. Sperm count was done under the microscope. The determination of the sperm count was done using the Neubauer's counting chamber as discussed by Saalu *et al.,* (2012). This involves the placement of few drops of semen on a slide followed by addition of two drops of eosin Y and the covering of the slide with cover slip and examination under the microscope using X40 objective for sperm morphology. The sperm concentration was then calculated. The magnification of light microscope at X400 was used in the evaluation of sperm morphology. Five hundred sperm from the sample was scored for morphological abnormalities according to Ilbey *et al.,* (2009). Abnormal sperm morphology was considered to have the following features including detached head, round head and rudimentary tail and expressed as a percentage of normal sperm morphology. Vitality characteristics of the isolated sperms were analyzed as per WHO laboratory manual in examining human semen (1999), this is a modified Blom's technique that uses a 2-step eosin-nigrosin technique in obtaining the dark background for contrast and yields reliable evaluation using ordinary microscope optics. The non-motile sperms were identified from other objects such as erythrocytes, dirt, spermatids or leukocytes, erythrocytes by their intensity and size. High and low gates for these characteristics were defined as factors of the mean size or intensity of the motile sperm.

Histopathological Analysis of Animals' Organs

The preparation of tissues for histological studies was done at Rivers state University, College of Medical Sciences/Histology lab as follows. It involved eight main stages: Preparation of tissues for histological studies involved Fixation, Dehydration, Clearing, and Impregnation with paraffin wax, Sectioning, Staining and Mounting. Tissues were fixed by immersing in 10% Formalin for 24 hours. This was done to preserve the tissues and prevent autolysis. After fixation tissues were treated with increasing strengths of alcohol from 70%, 80%, 90% and two changes of absolute alcohol to dehydrate them. The dehydrated tissues were then treated with two changes of xylene for two hours in each, in order to remove alcohol and prepare them for infiltration with molten paraffin wax at 600C. Infiltration with molten paraffin wax was done by immersing tissues in molten paraffin wax for two hours, to increase the consistency of the tissues and to facilitate sectioning of thin slices for microscopy. The tissues were fitted into suitable cassettes which were attached to a rotary microtome and one cell thick sections made (approximately 3-5µm thick). The tissue sections were attached on to glass slides and incubated in an oven for one hour at 65-700C to remove all the paraffin wax. The sections were then stained with Haematoxylin for twenty minutes and counterstained with Eosin for three to five minutes. The stained slides were mounted using DPX and studied under the microscope. Tissues were prepared for histological observation as previously described by (Cardiff *et al.,* 2014). The sections were examined at low magnification (x400) and at high magnification (x1000) using an Olympus microscope (Japan) fitted with a Kodak camera. Several photomicrographs were taken in bright field.

Statistical Analysis

The data generated from this study were analyzed using SPSS version 22.0 statistical package. The first value indicates the mean while the second values indicate the standard error of mean of the body weight of the rats. The p-value was calculated to be less than 0.05 indication a significant value and non-significant for values higher than 0.05.

RESULT AND ANALYSIS

Table 1: Mean body weight (g)/SEM

Groups	Initial	Week 1	Week 2
GROUP 1	85.0 ± 1.00	100.0 ± 1.00	135.5 ±3.50
GROUP 2	82.5 ± 4.50	86.5 ± 9.50	76.0 ± 13.00
GROUP 3	99.5 ± 0.50	153.5 ± 3.50	111.5 ± 0.50
GROUP 4	100.0 ± 22.00	99.5 ± 15.50	137.5 ± 40.50
GROUP 5	176.5 ± 3.50	142.0 ± 5.00	138.5 ± 8.50

n = 2; mean ± SEM.

Group 1 = Normal Control (NC), Group 2 = 2mg/kg of Cadmium chloride, Group 3 = 2mg/kg of Cadmium chloride plus (+) 50mg/kg of Xylopia aethiopica, Group 4 = 2mg/kg of Cadmium chloride plus (+) 100mg/kg of Xylopia aethiopica, Group 5 = 100mg/kg of Xylopia aethiopica

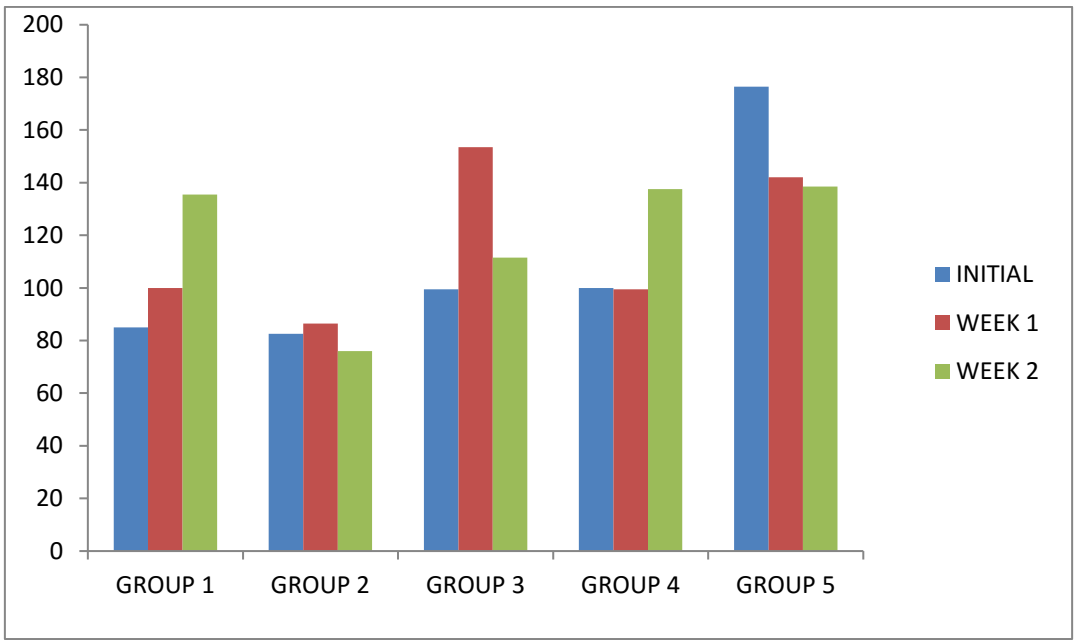


Figure 1: **showing Mean body weight (g)/SEM**

RESULTS ON BODY WEIGHT

In the present study, *Xylopia aethiopica* and cadmium chloride was administered to 20 adults male wistar rats for a period of 14 days. The rats were weighed just before administration, after 7 days of administration and after 14 days of administration. The results obtained showed that body *Xylopia aethiopica* and cadmium chloride have an effect on the body weight of the animals. Table 1 shows the effect of treatment of ethanolic seed extracts of *Xylopia aethiopica* on body weight (g) in cadmium chloride induced toxicity in wistar rats.

From table 1, Group 1 which is the control group showed a progressive increase in the weight with the initial mean body weight of 85.0 ± 1.00g to 100.0 ± 1.00g after 7 days and 135.5 ±3.50g after 14 days. The control group was given distilled water and standard rodents pellets feed.

Group 2 which was treated with 2mg/kg body weight of cadmium chloride showed a decrease in the body weight of the rats when compared to the control group. They had an initial mean body weight of 82.5 ± 4.50g. The mean body weight increased after 7 days of administration to 86.5 ± 9.50g but decreased after 14 days of administration to 76.0 ± 13.00g.

Group 3 treated with 2mg/kg body weight of cadmium chloride plus 50mg/kg body weight of *Xylopia aethiopica* showed a decrease in the mean body weight when compared to the control group. The initial mean body weight was seen as 99.5 ± 0.50g. There was however an increase in the mean body weight after 7 days of administration to 153.5 ± 3.50g. this could be as a result of extract treatment. However, there was a decrease after 14 days to 111.5 ± 0.50g.

Group 4 rats which were administered 2mg/kg body weight of cadmium chloride plus 100mg/kg body weight of *Xylopia aethiopica* showed an increase in the mean body weight when compared to the control. The initial mean body weight was seen as 100.0 ± 22.00g. after 7 days of administration, the mean body weight of rats decreased to 99.5 ± 15.50g. The final mean body weight of rats was seen as 137.5 ± 40.50g.

Group 5 rats treated with 100mg/kg body weight of *Xylopia aethiopica* showed an overall decrease in the mean body weight of animals. The rats were seen to have an initial mean body weight of 176.5 ± 3.50g, 142.0 ± 5.00g after 7 days of administration and 138.5 ± 8.50g after 14 days of administration.

Results showing effect of treatment with seed extracts of Xylopia aethiopica on sperm parameters in Cadmium chloride induced toxicity in male wistar rats:

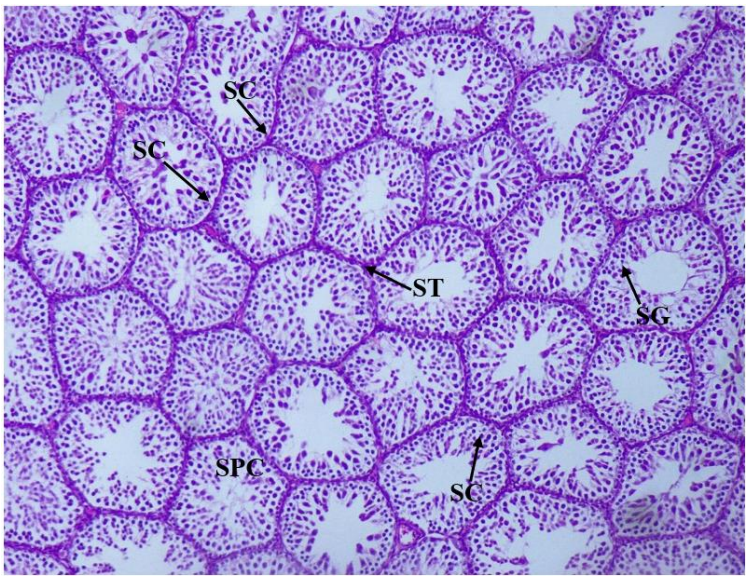
Table 2: Mean Semen analysis /SEM

Groups	Motility	Morphology	Vitality	Count (X10^6/Ml)
Group 1	25.0 ± 5.00*	70.0 ± 0.00 *	75.0 ± 5.00*	360.0 ± 50.00*
Group 2	35.0 ± 5.00*	65.0 ± 5.00*	72.5 ± 2.50*	230.0 ± 20.00*
Group 3	42.5 ± 2.50*	57.5 ± 2.50*	62.5 ± 2.50*	125.0 ± 25.00*
Group 4	20.0 ± 0.00*	75.0 ± 5.00*	82.5 ± 2.50*	375.0 ± 75.00*
Group 5	15.0 ± 5.00*	85.0 ± 5.00*	87.5 ± 2.50*	525.0 ± 25.00*

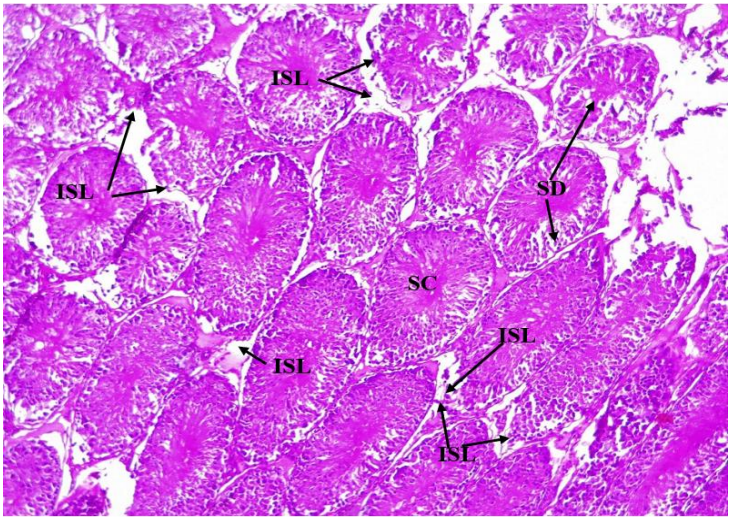
n = 2; mean ± SEM. One way ANOVA *test. p<0.05 when compared with the control.*

Group 1 = Normal Control (NC), Group 2 = 2mg/kg of Cadmium chloride, Group 3 = 2mg/kg of Cadmium chloride plus (+) 50mg/kg of Xylopia aethiopica, Group 4 = 2mg/kg of Cadmium chloride plus (+) 100mg/kg of Xylopia aethiopica, Group 5 = 100mg/kg of Xylopia aethiopica.

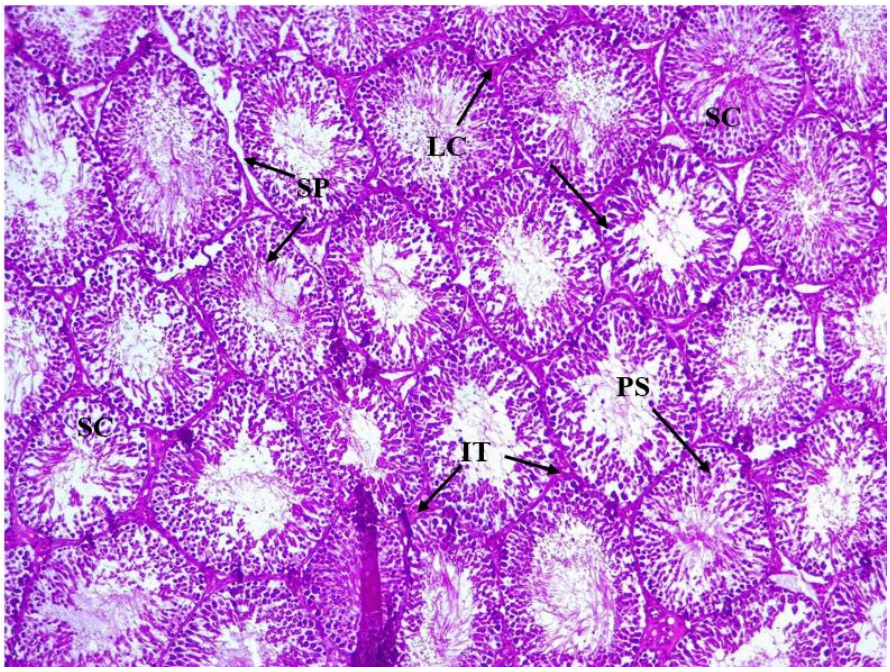
HISTOLOGICAL ANALYSIS



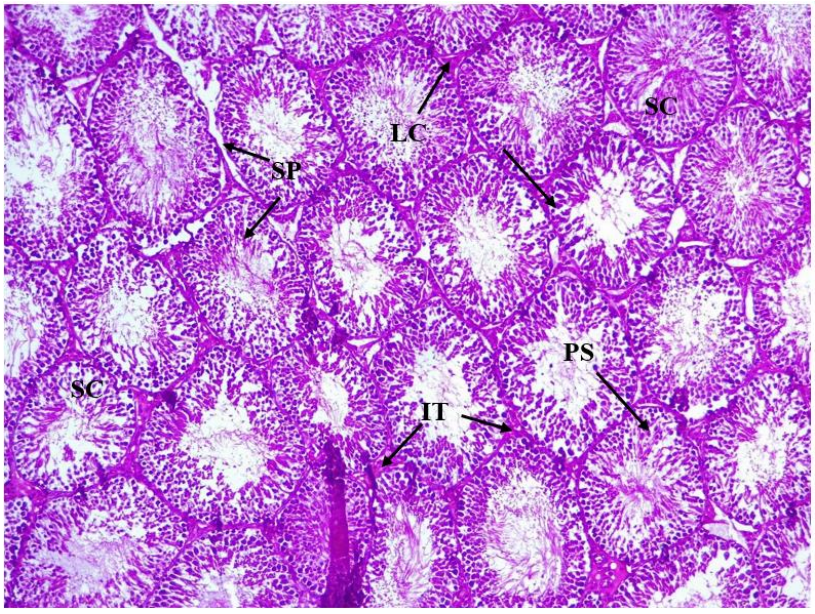
Photomicrograph section of testes of Wistar rat from control group given distilled water and standard rodent pellets feed. Section showed seminiferous tubules with sertoli cells (SC), spermatogonia (SG), primary spermatocytes (SPC) and spermatids. The interstitium (ST) showed Leydig cells. Germ cell maturation is variable around the tubule. H&E X100.



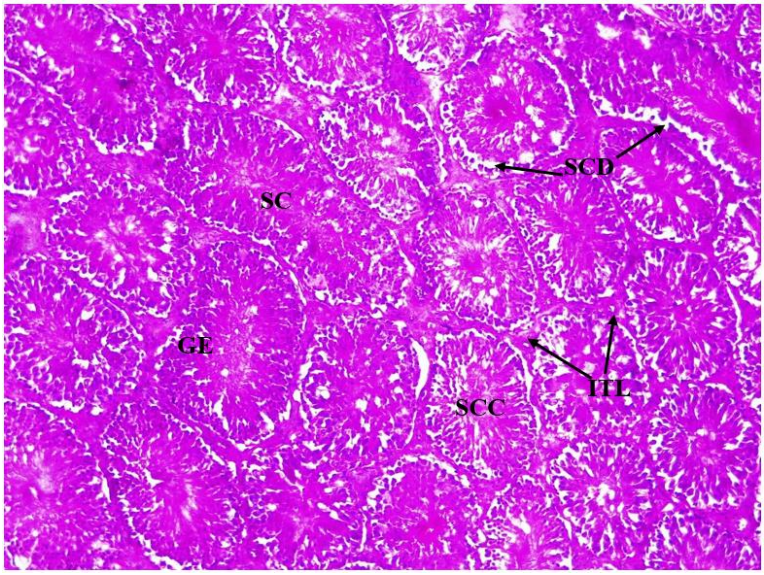
Photomicrograph section of Testicular tissue from Wistar rats treated with Cadmium alone. Section showed sertoli cells degeneration (SD) with spermatids, primary spermatocytes and secondary spermatocytes degeneration. There are interstitial cellular lesions of Leydig cells (ISL). Few viable sertoli cells are seen (SC).



Photomicrograph section of the seminiferous tubules of testes tissue of Wistar from group 3 and was administered 2mg/kg of cadmium and treated with 50mg/kg of *Xylopia aethiopica* for 14 days. Section showed recovered sertoli cells (SC) with secondary spermatids (SP), primary spermatids (PS) and germinal cells (GC). The interstitium (IT) also contain Leydig cells.



Photomicrograph section of the seminiferous tubules of testes tissue of Wistar rat showing administered 2mg/kg of cadmium and treated with 100 mg/kg of *Xylopia aethiopica* for 14 days (Group 4). Section showed mildly recovered sertoli cells (SC) with secondary spermatids (SP), primary spermatids (PS) and germinal cells (GC). The interstitial layer are intact (IL) but some sertoli cells showed sloughing off from the basement membrane.



Photomicrograph section of the seminiferous tubules of testes tissue of Wistar rat administered *Xylopia aethiopica* for 14 days (Group 5). Section showed sertoli cells (SC) with secondary spermatids (SP), primary spermatids (PS) and germinal cells (GE). The interstitial layer are intact (ITL) but some sertoli cells (SCD) showed mild distortion from the basement membrane

From table 2, Group 2 rats treated with 2mg/kg body weight of cadmium chloride only showed sperm characteristics as follows: sperm motility (35.0 ± 5.00). sperm morphology (65.0 ± 5.00), sperm vitality (72.5 ± 2.50), sperm count (230.0 ± 20.00 x10^6/ml). There was an increase in the motility of the sperm when compared to the control

Group 3 rats treated with 2mg/kg of Cadmium chloride plus plus 100mg/kg of *Xylopia aethiopica* show an increase in the sperm motility when compared to the control and a reduction in other sperm parameters. They can be seen as follows: sperm motility (42.5 ± 2.50), sperm morphology (57.5 ± 2.50), sperm vitality (62.5 ± 2.50), sperm count (125.0 ± 25.00 x10^6/ml)

The results obtained from table 2 show a significant increase in the sperm parameters of rats treated with 2mg/kg of Cadmium chloride plus plus 100mg/kg of *Xylopia aethiopica* (Group 4) and 100mg/kg of *Xylopia aethiopica* (Group 5) when compared with the control. There was however a reduction in the sperm motility of both groups showing sperm motility of 20.0 ± 0.00 and 15.0 ± 5.00 respectively. The sperm characteristics of Group 4 rats are shown as: sperm morphology (57.5 ± 2.50), sperm vitality (82.5 ± 2.50), sperm count (375.0 ± 75.00 x10^6/ml). While the sperm characteristics of Group 5 rats are seen as: sperm morphology (85.0 ± 5.00), sperm vitality (87.5 ± 2.50), sperm count (525.0 ± 25.00 x10^6/ml).

DISCUSSION

Effect on Body weight

From table 1, it can be seen that both *Xylopia aethiopica* and cadmium affects the body weight. Group 1 rats which were the control animals showed a progressive increase in body weight from 85 ± 1.00g at the start of the experiment to 100.0 ± 1.00g after one week and 135.5 ±3.50g after two weeks.

From table 1, group 2 animals treated with 2mg/kg body weight of cadmium showed a decrease in the total body weight when compared to the control. This could be as a result of oxidative stress induced by cadmium, which is in line with the findings of Singh *et al.,* 2011, that oxidative stress is a mechanism of cadmium toxicity (Singh *et al.,* 2011). Cadmium chloride toxicity affects brain function, nutritional uptake in the gastrointestinal tract and metabolic activities.

From table 1, Group 3 animals treated with 2mg/kg body weight of cadmium plus 50mg/kg body weight of *Xylopia aethiopica* showed a significant decrease in the body weight of the animals. This could also be as a result of oxidative stress induced by cadmium chloride toxicity.

Table 1 also showed that Group 4 treated with 100mg/kg of *Xylopia aethiopica* plus 2mg/kg of cadmium showed an increase in body weight when compared to the control which can be attributed to the anti-oxidant properties of *Xylopia aethiopica* against free radicals from the cadmium. This is in accordance with a study carried out by Tijani *et al.,* 2022.

Also, from table 1 Group 5 treated with only 100mg showed a reduction in body weight compared to the initial body weight, which is an indication that *Xylopia aethiopica* plays a role in lipid metabolism, which is in agreement with the report of Chris *et al.,*

2015. However, when compared to the control group, there was an increase in the body weight. This could be as a result of the differences in the initial body weights of animals.

Sperm parameters

Male infertility is generally attributed to insufficiencies in the semen which are mainly considered by low motility and viability of sperm (Banihani *et al.,* 2012). Therefore, low production of sperm (oligospermia), poor motility of sperm or abnormal morphology of sperm or combination of the three factors (Guzick *et al.,* 2001) leads to infertility in males.

From table 2, group 2 animals treated with cadmium chloride only showed a reduction in sperm characteristics when compared to the control. The table also showed a reduction in the sperm parameters of Group 3 rats treated with cadmium chloride and low dose *Xylopia aethiopica*. The rats showed distortion in the morphology (shape) of the sperm cells and leading to reduction of vitality in Group 2 and 3. Reduced sperm counts can also be observed in the groups treated with cadmium chloride.

Various mechanisms may explain reduced sperm quality induced by Cadmium. The alteration in sperm parameters could be attributed to direct effect on testicular tissue which leads to reproductive dysfunction such as reduced sperm count, motility and morphology (de Souza *et al.,*2010). Cadmium specifically disrupts Sertoli-germ cell tight junctions and thus leads to the failure of spermatogenesis. Profound testicular damage displays destruction of the seminiferous tubules and progressive sloughing of immature germ cells which result in abnormalities in early sperm development (Siu *et al.,* 2009, Zhang *et al.,* 2010). Furthermore, low dose exposure to Cadmium affects steroid hormone actions involved in the regulation of reproductive processes. The decrease in sperm count and quality is correlated with decrease in testosterone levels and oxidative damage (Pandya *et al.,* 2012, Acharya *et al.,* 2008).

From table 2, Group 4 and 5 showed increase in vitality, sperm count and morphology. The increased sperm counts indicate improved fertility because of extract treatments. This is in line with the findings of Woode *et al.,* 2011. Increased levels of testosterone in group 4 and 5 are evident in the increase in sperm count as testosterone directly affects fertility. Testosterone works with Follicle Stimulating Hormone to help generate sperm (spermatogenesis) thereby increasing sperm count. However, extremely high concentration of testosterone causes reduction in sperm production (Patel,2019; Amory, 1998).

Histological Analysis

Group 1 (control) showed seminiferous tubules with sertoli cells (SC), spermatogonia (SG), primary spermatocytes (SPC) and spermatids. The interstitium (ST) showed Leydig cells. Germ cell maturation is variable around the tubule.

In Group 2 rats treated 2mg of Cadmium alone, Sertoli cells degeneration are seen along with spermatids, primary spermatocytes and secondary spermatocytes degeneration. This shows that cadmium chloride affects spermatogenesis and thereby decreases number of spermatozoa produced. There are also interstitial cellular lesions of Leydig cells. The interstitial cells of Leydig are responsible for the production of the male sex hormone which is Testosterone. Lesions in the Leydig cells results in decrease in the production of testosterone.

Group 3 and 4 showed tissue protection from the damaging effect of cadmium with recovered Sertoli cells, primary and secondary spermatocytes and Leydig cells. This can be attributed to the possession of antioxidant properties of *Xylopia aethiopica* to reduce the oxidative stress induced by cadmium chloride. Some studies have shown the damaging effect of oxidative stress in causing hormonal imbalance and dysfunction or action through the inhibition of the rate limiting enzyme, HMG-CoA reductase, in the synthesis of cholesterol, which is the precursor molecule of all steroid hormones. HMG-CoA reductase catalyze the conversion of HMG-CoA to mevalonic acids (Omeh *et al.,* 2014)

Group 5 rats treated with 100mg of *Xylopia aethiopica* showed intact interstitial layer but mild distortion of the Sertoli cells from their basement membrane. This finding is concurrent with the study of Abarikwu *et al.,* 2017 who showed the antifertility effects of *Xylopia aethiopica* on male wistar rats. However, the study was carried out for a longer period of time.

CONCLUSION

In this study, it was deduced that *Xylopia. aethiopica* possesses ameliorative effect against cadmium chloride on testes. This is seen in tissue repair in rats treated in with 100mg/kg body weight of the ethanolic extract of the plant. These effects may be as a result of its antioxidants property. However, *Xylopia aethiopica* may possess some antifertility effects if used for a longer period of time.

RECOMMENDATION

It is recommended that further studies be carried out to determine the actual dosage and mechanism of protection of human consumption of the ethanolic extract of *Xylopia aethiopica.*

It is also recommended that further research should be carried out on the duration of administration of *Xylopia aethiopica.*

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