Niger. J. Physiol. Sci. 36 (December 2021): 227– 236
www.njps.physiologicalsociety.com
https://doi.org/10.54548/njps.v36i2.12

Niger. J. Physiol. Sci.

Full-Length Research Article

Comparative Effects of Methanol and Aqueous Extracts of *Corchorus olitorius* Plant on Haematology and Some Reproductive Indices of Male Wistar Rats

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Summary: *Corchorus olitorius* is a vegetable plant/shrub and the leaves are very nutritious and rich in vitamins, minerals and dietary fibers. The study was carried out to evaluate the effect of the aqueous and methanol leaf extracts of this plant on some male reproductive indices in male Wistar rats Forty-five mature male rats of about 12 weeks old, each weighing about 120g were used for this study, kept in a cage and fed with commercial rat pellets and water was given at ad-libitum. They were randomly divided into three groups A, B and C of 15 rats per group. The leaf extract (250mg/kg) was administered orogastrically once daily for 21 days. Group A and B were treated with methanol and aqueous leaves of Corchorus extract respectively and Group C was given distilled water and served as the control. Five rats per group were sacrificed and the following analysis was carried out namely, haematology, testosterone assay and semen. In this study, it was observed at the first-week post-treatment that there was a significant ($p \leq 0.05$) decrease in the PCV and haemoglobin values of group A (Methanol treated) rats compared to the control group but the values later increased at the second week and third-week post-treatments. There was also a significant decrease in spermatozoa motility in the methanol treated groups A and aqueous treated B compared to the control group C (distilled water treated) at the first, second and third-week post-treatments. Also, with the results of the serum testosterone level of group A and B compared to group C. The value was higher in group A followed by group B whereas, at the second week and third week, there was no significant difference in the values of the serum testosterone levels compared to the control groups. It is therefore concluded that the methanol and aqueous extract of *Corchorus olitorius* leaves significantly decreased sperm motility in male albino rats hence could decrease male fertility.

Keywords: *Corchorus olitorius, Wistar rats, fertility, spermatozoa, testes. Reproductive indices.*

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Manuscript received- February 2021; Accepted- August, 2021

INTRODUCTION

Corchorus olitorius is commonly known as Nalta jute, Tossa jute (Nyadamu *et al*., 2017), Jew's mallow (Duke and James, 1979) West African sorrel and bush okra. It is a species of shrub in the family Malvaceae. It is the primary source of jute fibres (Holm *et al.*, 1997). Some Nigerians names for the crop include Ewedu in (Yoruba), Achingbara in (Igbo) and Rama in the Hausa Language. The plant grows well in the lowland tropics, up to an elevation of around 700 meters (Tindall, 1983). They are reported to tolerate annual precipitation between 400 and 4290mm, and an annual average temperature range of 16.8 to 27.5^{o}C (Ghorai, 2008). Phytochemical screening on both methanol and aqueous extracts revealed some constituents common to both solvent extracts except alkaloids which were absent in methanol extracts (Barku *et al.*, 2013).

Several studies were conducted on the chemical constituents of *Corchorus olitorius*. These chemicals include cardiac glycosides (Rao *et al*., 1972, Sanilova and Lagodich, 1998) Triterpene chemical constituents by Manzoor *et al.* (1971 and 1979) and Mukherjee *et al.* (1998), Ionones chemical constituent by Yoshikawa *et al.* (1997), Phenolics chemical constituents by Yoshikawa *et al*. (1997), Azuma *et al*. (1999) and Mukherjee *et al*. (1998) and the lignin content of a mature *Corchorus olitorius* stem by Tanmoy *et al*. (2014). This plant is important as a nutritive vegetable rich in K, Ca, P, Fe ascorbic and carotene as reported by Azuma *et al.* (1999).

The leaves and young fruits are used as a vegetable, the dried leaves are used for tea and as a soup thickener and the seeds are edible. Young leaves are added to salads whilst older leaves are cooked as a pot-herb. The leaves quickly become mucilaginous when cooked. The dried leaves can be used as a thickener in soups (Facciola, 1990). It is an important leaf vegetable in Cote d'Ivoire, Benin, Nigeria, Cameroon, Sudan, Uganda, Kenya and Zimbabwe. It is also cultivated and eaten in the Caribbean and Brazil, in the Middle East and India, Bangladesh, Japan and China. In Nigeria, the leaves are boiled to make a sticky, mucilaginous sauce which is served with balls of cassava that are otherwise rather dry (Grubben, 2004).

The leaves are demulcent diuretic febrifuge and tonic (Chopra and Nayar, 1986; Nishiumi *et al.*, 2005). They are used in the treatment of chronic cystitis, gonorrhoea and dysuria (Chopra and Nayar, 1986). A cold infusion is said to restore the appetite. Injection of Olitoriside an extract from the plant, markedly improve cardiac insufficiencies and have no cumulative attributes; hence, it can serve as a substitute for strophanthin (Ghorai, 2008). The methanol

extract of its leaves has been reported to show a broad-spectrum antibacterial and it has wound healing properties (Barku *et al.,* 2013). It is speculated by Oyedeji *et al.* (2013) that the plant has a deleterious effect on some reproductive functions in male albino rats also that *Corchorus olitorious* is known to contain a high level of iron and folate which are useful for the prevention of anaemia (Oyedele *et al.,* 2006). Furthermore, the different parts of *Corchorus olitorious* were found to exhibit diverse biological activities. The leaves of *Corchorus olitorious* were reported to exhibit antioxidant (Oboh *et al.,* 2009) antitumor (Furumot *et al.,* 2002), gastroprotective (Al-Batran *et al.,*2013) antibacterial and antifungal (Iihan, *et al.,* 2007) anti-inflammatory and analgesic activities (Das *et al.,* 2010).

Wistar rats are an outbred strain of albino rats belonging to the species Rattus norvegicus. The strain was developed at the Wistar Institute for use in biological and medical research and is notably the first rat strain developed to serve as a model organism. (Clause 1988). The rats because of their marked anatomical homology to the human cardiovascular system (Casteleyn *et al.* 2017), proved valuable in psychological studies of learning and other mental processes (Vandernbergh, 2000), a study also found rats to possess metacognition, a mental ability previously documented in humans as reported by Foote *et al*. (2007) and Wallinford *et al. (*2010).

Pal *et al.* (2009) reported some antifertility effects of methanol extract of *Corchorus olitorious* while Oyedeji *et al*. (2013) reported the antifertility effect of the aqueous extract of the plant. Thus, the study aimed to compare the effects of methanol and aqueous extracts of *Corchorus olitorious* leaves on some reproductive indices in male Wistar rats.

MATERIALS AND METHODS

Animals: Forty-five adult male rats of about 12 weeks old, each weighing 120g were used for this study. They were kept in cages at the experimental Animal Unit at the Faculty of Veterinary Medicine, University of Ibadan. They were fed with commercial rat pellets and water was given *ad libitum.*

The rats were grouped into 3 (A, B and C) of 15 rats each.
Group A- was treated with methanol extract
Group B- was treated with aqueous
Group C- was the control which was given distilled water.
250mg/kg of the plant extracts were used for these experiments and were administered orogastrically (Oyedeji, *et al*., 2013). The experimental rats were sacrificed at weeks 1, 2 and 3 post-treatment.

Ethical consideration: The research proposal was approved by the Animal Care and Use Research Ethics Committee (ACUREC) of the University of Ibadan. The andrological examination was carried out on the rats and they were acclimatized for 2 weeks with other veterinary attention.

Plant Collection & Identification: The fresh leaves of *Corchorus olitorious* plant were collected from the University farm and the botanical identification was done at the Department of Botany Herbarium, the University of Ibadan with Botanical ID no UIH-22616.

Plant Extraction: The leaves of the plant were plucked and cleaned. The leaves were then air-dried for two weeks after which 200g of the dried leaves were pulverized.

For Aqueous extraction, 1000g of the grounded dried sample was weighed, transferred into a glass container and 10 litres of distilled water was added, stirred every two hours with a glass rod and allowed to stay for 24 hours. The solvent (now containing the extract) was collected using a muslin bag and the filtrate was further filtered using 1mm Whatman filter paper. the filtrate was then concentrated with the aid of a rotatory evaporator set at 50^{o}c, after which the extract was further concentrated using a vacuum oven set at 50^{o}C with a pressure of 700mmHg. The total yield from the aqueous extraction was 84.931 with a percentage yield of 8.5%.

For Methanol extraction, 1000g of the dried sample was transferred into a glass container and 5 litres of pure methanol was added, stirred every two hours with a glass rod and allowed to stay for 72 hours. The resulting solution was collected using a muslin bag and the filtrate was further filtered using 1mm Whatman filter paper. This process was repeated twice with another 5 litres of pure methanol added each time to the shaft. The combined filtrate was then concentrated with the aid of a rotatory evaporator set at 40^{o}C, after which the concentrate was further concentrated using a vacuum oven set at 40^{o}C with a pressure of 700mmHg.

Administration of the extracts: 0.2 ml of 250mg/kg of the leaf extracts was given to the rats. The rats were picked up properly and a syringe and cannula were used to administer the plant extracts orogastrically

The infraorbital lateral cantus method was used which entailed blood being collected from the orbital sinus as described by Jain, (1986). The rats were anaesthetized in a glass chamber containing ether soaked in cotton wool. Anaesthesia was achieved in about 2 minutes. Capillary tubes used were filled with the blood samples up to about plain 2/3 and were analyzed using the method of Jain, (1986) and Coles (1989).

Blood samples from the rats were collected, 3ml in a sample bottle with ethylenediaminetetraacetic acid (EDTA) and 2ml in a plain bottle slanted to facilitate separation of serum for biochemical analysis.

Semen Collection: The male rats were put into a glass chamber containing cotton wool soaked in ether and allowed to lose consciousness. The testicles were exteriorized through a mid- caudoventral abdominal incision with a sterile scalpel blade. Sperm cells were then collected from cauda epididymis and analyzed as described by Oyeyemi and Fayomi (2011) and Zemjanis (1970).

Bodyweight, testicular & Epididymal Biometry: Testicular parameters like the width of the testis, length of individual right and left testis were measured using digital vernier callipers. The bodyweight of the rats and the weight of the epididymis, individual right and left testes were taken using a digital scale.

Statistical Analysis: - All data obtained were expressed as means with the standard errors and one-way analysis of variance was used to compare means and the significance was reported as ($P \leq 0.05$).

RESULTS

Semen characteristics: Comparison of results of groups within weeks revealed that the first-week post-treatment for semen characteristics value of spermatozoa motility is significantly higher in group C which is the control group than group A which was treated with methanol extract and that of group B which was treated with aqueous extract but the value of spermatozoa motility of group A is significantly higher than the value of group B.

The results for the second week (Figure 2) revealed that sperm motility decreased significantly in groups A and B compared to group C whereas there is a non-significant difference in sperm liveability in all the groups.

The results for third-week semen characteristics (Figure 3) revealed that there was a significant decrease in sperm motility of groups A and B compared to group C. The value is higher in group C followed by group B which is followed by group A. There is no significant difference in sperm liveability in all the groups.

Group A showed a progressive decrease over the three weeks (88.75, 75.00 and 68.00%) while there was a non-significant decrease in the percentage of sperm liveability. While group B revealed a progressive decrease of sperm motility and liveability at the first and second week after treatment but there was a non-significant increase at the third week in both parameters. There was a non-significant change in the values in group C for both sperm motility and liveability.

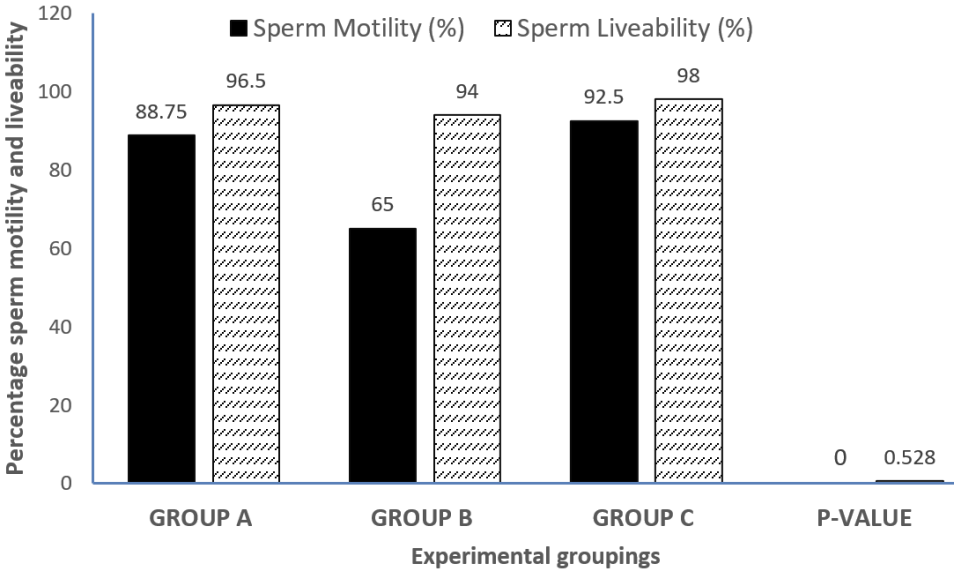

Figure 1
Semen characteristics after one week of oral administration of aqueous extract of *Corchorus olitoriorus*

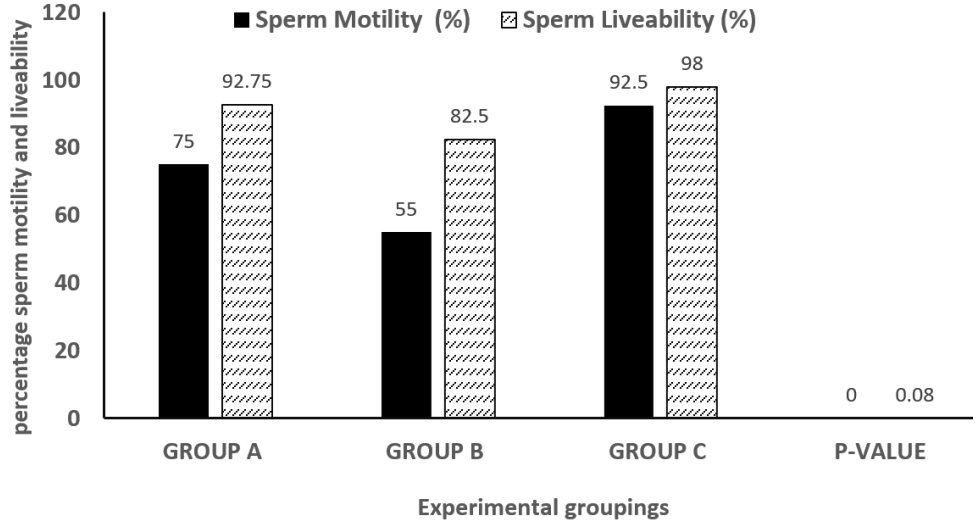

Figure 2
Semen characteristics after two week of oral administration of *Corchorus olitorius.*

Spermatozoa morphological abnormalities: The results for first-week morphological abnormalities (Table 2) that there is no significant difference in spermatozoa morphological abnormalities in the treated groups compared to the control group. The conspicuous spermatozoa morphological abnormalities observed were tailless head, headless tail, rudimentary tail, bent tail, curved tail, curved midpiece, bent midpiece and looped tail.

Haematology: The haematology values for the first-week post-treatment (Table 5) revealed that packed cell volume and haemoglobin concentration of group A were significantly lower than that of groups B and C. The Red blood cells of group A was significantly higher than that of group B which is also significantly higher than that of group C.

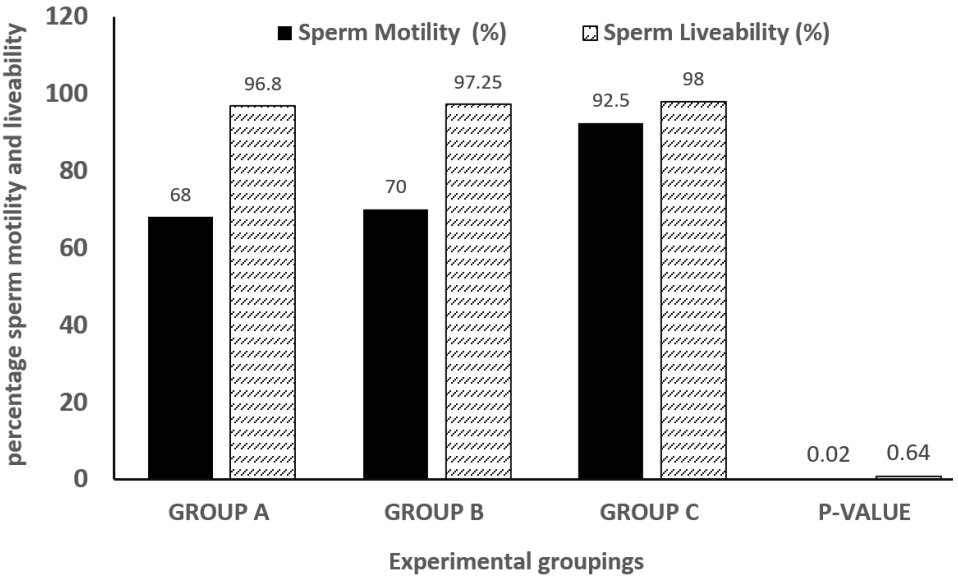

Figure 3
Semen characteristics after the third week of oral administration of *Corchorus olitorius.*

Table 1.
Comparison of values of motility and livability across the three weeks

	First Week			Second Week			Third Week		
Parameter	A	B	C	A	B	C	A	B	C
Sperm Motility (%)	88.75± 3.15	65.00± 2.89	92.50± 2.50	75.00± 2.89	55.00± 2.89	92.50± 2.50	68.00± 3.74	70.00± 4.08	92.50± 2.50
Sperm Livability (%)	96.50± 0.87	94.00± 3.08	98.00± 0.00	92.75± 3.20	82.50± 4.33	98.00± 0.00	96.80± 0.73	97.25± 0.75	98.00± 0.00

Table 2
Results For Sperm Cell Morphological Abnormalities after one Week Post Treatment

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
Tailless head (%)	4.00±5.78 [a]	4.50±0.65 [a]	4.25±0.75 [a]	0.87	NS
Headless tail (%)	4.00±0.41 [a]	4.75±0.63 [a]	4.75±0.25 [a]	0.44	NS
Rudimentary tail (%)	1.50±0.29 [a]	2.00±0.41 [a]	2.25±0.48 [a]	0.44	NS
Bent tail (%)	8.00±0.58 [a]	8.00±0.41 [a]	8.50±0.65 [a]	0.77	NS
Curved tail (%)	9.25±0.48 [a]	8.25±0.63 [a]	8.75±0.75 [a]	0.55	NS
Curved midpiece (%)	9.25±0.48 [a]	7.50±0.50 [a]	8.25±0.25 [a]	0.05	NS
Bent midpiece (%)	9.50±0.29 [a]	8.75±0.48 [a]	8.75±0.63 [a]	0.48	NS
Looped tail (%)	2.50±0.29 [a]	2.50±0.29 [a]	1.75±0.48 [a]	0.29	NS
Total abnormal cells	48.00±1.22 [a]	46.25±0.48 [a]	47.25±2.66 [a]	0.77	NS
Total cells	403.75±2.40 [a]	407.50±3.23 [a]	403.75±2.39 [a]	0.55	NS

NS=Not significant, S=Significant, [abc]=Means in the same row with different superscript differ significantly($p<0.05$).

Table 3
Results for Sperm Cell Morphological Abnormalities (%) After The Second Week of Treatment.

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
Tailless head	4.50±0.65 [a]	3.75±0.48 [a]	4.25±0.75 [a]	0.36	NS
Headless Tail	4.25±0.48 [a]	4.00±0.41 [a]	4.75±0.25 [a]	0.96	NS
Rudimentary Tail	2.00±0.41 [a]	2.25±0.48 [a]	2.25±0.48 [a]	0.10	NS
Bent Tail	8.50±0.65 [a]	8.75±0.75 [a]	8.50±0.65 [a]	0.05	NS
Curved tail	8.25±0.48 [a]	8.50±0.29 [a]	8.75±0.75 [a]	0.21	NS
Curved midpiece	9.00±0.41 [a]	8.00±0.41 [a]	8.25±0.25 [a]	2.05	NS
Bent midpiece	8.50±0.29 [a]	7.75±0.48 [a]	8.75±0.63 [a]	1.15	NS
Looped tail	1.75±0.48 [a]	2.25±0.48 [a]	1.75±0.48 [a]	0.36	NS
Total abnormal cells	46.75±0.63 [a]	45.25±1.03 [a]	47.25±2.66 [a]	0.38	NS
Total cells	403.75±2.39 [a]	406.25±2.39 [a]	403.75±2.39 [a]	0.36	NS

N=Not significant, S=Significant, [abc]=Means in the same row with different superscript differ significantly($p<0.05$).

TABLE 4
Results for Sperm Cell Morphological Abnormalities after Third Week of Treatment

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
Tailless head	5.00±0.41 [a]	5.00±0.41 [a]	4.25±0.75 [a]	0.63	NS
Headless tail	4.50±0.65 [a]	4.25±0.48 [a]	4.75±0.25 [a]	0.27	NS
Rudimentary tail	2.25±0.48 [a]	2.25±0.48 [a]	2.25±0.48 [a]	0.00	NS
Bent tail	8.75±0.48 [a]	9.50±0.29 [a]	8.50±0.65 [a]	1.11	NS
Curved tail	9.00±0.82 [a]	9.00±0.41 [a]	8.75±0.75 [a]	0.05	NS
Curved midpiece	9.50±0.50 [a]	8.25±0.63 [a]	8.25±0.25 [a]	2.21	NS
Bent midpiece	9.25±0.85 [a]	9.00±0.41 [a]	8.75±0.63 [a]	0.15	NS
Looped tail	2.25±0.48 [a]	2.00±0.41 [a]	1.75±0.48 [a]	0.30	NS
Total abnormal cells	50.50±2.10 [a]	49.25±1.38 [a]	47.25±2.66 [a]	0.60	NS
Total cells	402.50±2.50 [a]	403.75±3.75 [a]	403.75±2.39 [a]	0.06	NS

NS=Not significant, [abc]=Means in the same row with different superscript differ significantly (p<0.05).

Table 5.
Haematology Result after one Week of Treatment

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
PCV (%)	31.60±2.86[a]	38.40±1.60[b]	40.40±1.81[b]	0.03	S
HB (%)	10.47±0.90 [a]	12.80±0.53 [b]	12.72±0.46 [b]	0.04	S
RBC (x106uL)	8.83±0.37[a]	8.97±0.17[b]	6.72±0.27 [c]	0.00	S
WBC (x106uL)	8790.00±648.34 [a]	10240.00±342.56 [b]	5490.00±573.67 [c]	0.00	S
PLATELET	3.15 x 10^5±178239.61 [a]	1.45 x 10^5±5991.66 [a]	1.116 x10^5±25486.47 [a]	0.36	NS
LTM (%)	63.40±2.46 [a]	65.40±1.86 [a]	67.20±1.39 [a]	0.42	NS
NEUT	28.80±2.24 [a]	28.00±2.07 [a]	28.40±1.50 [a]	0.960	NS
MON (%)	3.40±0.51 [a]	3.40±0.51 [b]	1.80±0.20 [a]	0.03	S
EOS (%)	4.40±0.24 [a]	3.20±0.73 [b]	2.60±0.24 [a]	0.05	NS

NS=Not significant, S=Significant, [abc]=Means in the same row with different superscript differ significantly(p<0.05).
PCV=Packed cell volume, HB=Haemoglobin concentration, RBC=Red blood cell, WBC=White blood cell, LYM=Lymphocyte, NEUT=Neutrophils, MON=Monocytes, EOS=Eosinophils

Table 6.
Haematology Result after Second Week of Treatment

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
PCV (%)	43.40±1.57 [a]	40.00±1.64 [a]	40.40±1.81 [a]	0.33	NS
HB (%)	14.06±0.52 [a]	13.26±0.53 [a]	12.72±0.46 [a]	0.21	NS
RBC (x106uL)	7.12±0.17 [a]	6.54±0.21 [a]	6.72±0.27 [a]	0.22	NS
WBC (x106uL)	4350.00±359.17 [a]	4620.00±285.31 [a]	5490.00±573.67 [a]	0.21	NS
PLATELET	1.044 x10^5±6423.39 [a]	6.78x10^5±16144.35 [a]	1.116x10^5±25486.47 [a]	0.18	NS
LTM (%)	68.80±1.07 [a]	66.20±1.71 [a]	67.20±1.39 [a]	0.22	NS
NEUT	26.80±1.24 [a]	30.20±1.88 [a]	28.40±1.50 [a]	0.45	NS
MON(%)	1.60±0.40 [a]	2.20±0.37 [a]	1.80±0.20 [a]	0.34	NS
EOS (%)	2.80±0.20 [a]	1.40±0.51 [a]	2.60±0.24 [a]	0.46	NS

NS=Not significant, [abc]=Means in the same row with different superscript differ significantly(p<0.05).
PCV=Packed cell volume, HB=Haemoglobin concentration, RBC=Red blood cell, WBC=White blood cell, LYM=Lymphocyte, NEUT=Neutrophils, MON=Monocytes, EOS=Eosinophils
The Haematology results for week 3 (table 7) revealed that there is a non-significant difference in the parameters of groups A and B compared to the control group except for lymphocytes and neutrophils in which there is a significant decrease in the values of groups A and B compared to the control group C.

The white blood cell value was significantly lower in group A than that of group B which is also significantly lower than that of group C. The platelets value for group A was higher than that of group B which was also higher than that of group C but the values were not significantly different. The lymphocytes value for group A is non-significantly lower than that of group B which is also non-significantly lower than that of group C. The values of Neutrophils, Lymphocytes and Eosinophils were not significantly different.

Haematology values for the second-week post-treatment (Table 6) revealed that the Packed cell volume for group A is non-significantly higher than group B and group C whereas the value for group B is lower than that of group C. The Haemoglobin concentration in group A is non-significantly higher than that of group B which is also non-significantly higher than that of group C. The Red blood cell value for group A is non-significantly higher than that of groups B and C whereas the value for group C which is the control group is non-significantly higher than that of group B. The White blood cell value for group A is non-significantly lower than that of group B which is also non-significantly lower than that of group C. The Platelets value for group A is non-significantly higher than that of group B whereas the value for group C which is also the control group is non-significantly higher than that of groups A and B. The lymphocytes value for group A is non-significantly higher than that of groups B and C whereas that of group C which is the control group is non-significantly higher than that of group B.

Table 7
Haematology results after third week of treatment

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
PCV (%)	38.00±1.55 [a]	41.75±2.25 [a]	40.40±1.81 [a]	0.39	NS
HB (%)	12.80±0.44 [a]	14.15±0.79 [a]	12.72±0.46	0.19	NS
RBC (x106uL)	6.29±0.24 [a]	7.08±0.39 [a]	6.72±0.27 [a]	0.22	NS
WBC (x106uL)	4310.00±532.07 [a]	5450.00±250.00 [a]	5490.00±573.67 [a]	0.21	NS
PLATELET	$1.2378x10^5$±12018.32 [a]	$1.235x10^5$±14239.03 [a]	$1.116x10^5$±25486.47 [a]	0.87	NS
LTM (%)	60.40±1.72 [a]	60.50±2.50[a]	67.20±1.39[b]	0.03	S
NEUT	67.20±1.39[a]	60.50±2.50[b]	28.40±1.50 [c]	0.03	S
MON (%)	1.80±0.37 [a]	1.25±0.25 [a]	1.80±0.20 [a]	0.37	NS
EOS (%)	1.80±0.37 [a]	2.25±0.48 [a]	2.60±0.24 [a]	0.31	NS

N=Not significant, S=Significant, [abc]=Means in the same row with different superscript differ significantly(p<0.05).
PCV=Packed cell volume, HB=Haemoglobin concentration, RBC=Red blood cell, WBC=White blood cell, LYM=Lymphocyte, NEUT=Neutrophils, MON=Monocytes, EOS=Eosinophils

The Neutrophils value for group A is lower than those of groups B and C but the value of group B is higher than that of group A and the control group C. The monocytes value for group A is lower than that groups B and C but group B value is higher than that of the control group C. There is non-significant difference between the values of the monocytes and Eosinophils in all the groups.

Haematology results from animals treated orally with aqueous and methanol extracts of *Corchorus olitorius:*
The result of group A (Table 8) revealed an increase in the Packed cell volume and Haemoglobin concentration at both the second and third weeks compared to the first week while there is a progressive decrease in the Red blood cells, White blood cells and the Eosinophils from the first week to the third week after treatment. There was a decrease in platelets at the second and third weeks compared to the first week. There was an increase in neutrophils in the third week compared to the first and second week.

Table 8
Haematology Result of Group A after First Week, Second Week and Third Week Post Treatment.

GROUP	1ST WEEK	2nd WEEK	3rd WEEK
PCV (%)	31.60 ±2.86[a]	43.40 ±1.57 [a]	38.00 ±1.55 [a]
HB (%)	10.47 ±0.90 [a]	14.06 ±0.52 [a]	12.80 ±0.44 [a]
RBC (x106uL)	8.83 ±0.37[a]	7.12 ±0.17 [a]	6.29 ±0.24 [a]
WBC (x106uL)	8790.00 ±648.34 [a]	4350.00 ±359.17 [a]	4310.00 ±532.07 [a]
Platelet	$3.156x10^5$ ±178239.61 [a]	$1.044x10^5$ ±6423.39 [a]	$1.2378x10^5$ ±12018.32 [a]
LYM (%)	63.40±2.46 [a]	68.80±1.07 [a]	60.40±1.72 [a]
NEUT	28.80±2.24 [a]	26.80±1.24 [a]	67.20±1.39[a]
MON (%)	3.40±0.51 [a]	1.60±0.40 [a]	1.80±0.37 [a]
EOS (%)	4.40±0.24 [a]	2.80±0.20 [a]	1.80±0.37 [a]

[abc]=Means in the same row with different superscripts differ significantly(p<0.05).
PCV=Packed cell volume, HB=Hemoglobin concentration, RBC=Red blood cell, WBC=White blood cell, LYM=Lymphocyte, NEUT=Neutrophils, MON=Monocytes, EOS=Eosinophils

Haematology result of group B (Table 9) revealed a progressive increase in the Packed cell volume, Hemoglobin concentration, and Neutrophils from week one to week three post-treatment whereas there is a decrease in the Red blood cells, White blood cells, Platelets, Monocytes and Eosinophils at the second-and third-week post-treatment compared to the first week.

The haematology result of group C revealed that there is no difference in the haematology parameters from the first to the third-week post-treatment.

Table 9
Haematology Result of Group B after First Week, Second Week and Third Week post-treatment.

GROUP	1st WEEK	2ND WEEK	3RD WEEK
PCV (%)	38.40 ±1.60[b]	40.00 ±1.64 [a]	41.75 ±2.25 [a]
HB (%)	12.80 ±0.53 [b]	13.26 ±0.53 [a]	14.15 ±0.79 [a]
RBC (x106uL)	8.97 ±0.17[b]	6.54 ±0.21 [a]	7.08 ±0.39 [a]
WBC (x106uL)	10240.00 ±342.56 [b]	4620.00 ±285.31 [a]	5450.00 ±250.00 [a]
Platelet	$1.45x10^5$ ±5991.66 [a]	$6.78x10^5$ ±16144.35 [a]	$1.235x10^5$ ±14239.03 [a]
LTM (%)	65.40 ±1.86 [a]	66.20 ±1.71 [a]	60.50 ±2.50[a]
NEUT	28.00 ±2.07 [a]	30.20 ±1.88 [a]	60.50 ±2.50[b]
MON (%)	3.40 ±0.51 [b]	2.20 ±0.37 [a]	1.25 ±0.25 [a]
EOS (%)	3.20 ±0.73 [b]	1.40 ±0.51 [a]	2.25 ±0.48 [a]

[abc]=Means in the same row with different superscripts differ significantly(p<0.05).
PCV=Packed cell volume, HB=Haemoglobin concentration, RBC=Red blood cell, WBC=White blood cell, LYM=Lymphocyte, NEUT=Neutrophils, MON=Monocytes, EOS=Eosinophils

Table 10
Haematology Result Of Group C After First Week, Second Week And Third Week Post Treatment

Group	1st Week	2nd Week	3rd Week
PCV (%)	40.40±1.81 [b]	40.40±1.81 [a]	40.40±1.81 [a]
HB (%)	12.72±0.46 [b]	12.72±0.46 [a]	12.72±0.46 [a]
RBC (x106uL)	6.72±0.27 [c]	6.72±0.27 [a]	6.72±0.27 [a]
WBC (x106uL)	5490.00 ±573.67 [c]	5490.00 ±573.67 [a]	5490.00 ±573.67 [a]
PLATELET	1.116 x10 [5] ±25486.47 [a]	1.116 x10[5] ±25486.47 [a]	1.116 x10[5] ±25486.47 [a]
LYM (%)	67.20 ±1.39 [a]	67.20 ±1.39 [a]	67.20 ±1.39 [b]
NEUT	28.40 ±1.50 [a]	28.40 ±1.50 [a]	28.40 ± 1.50 [c]
MON (%)	1.80±0.20 [a]	1.80±0.20 [a]	1.80±0.20 [a]
EOS (%)	2.60±0.24 [a]	2.60±0.24 [a]	2.60±0.24 [a]

N=Not significant, S=Significant, [abc]=Means in the same row with different superscript differ significantly ($p<0.05$).
PCV=Packed cell volume, HB=Haemoglobin concentration, RBC=Red blood cell, WBC=White blood cell, LYM=Lymphocyte, NEUT=Neutrophils, MON=Monocytes, EOS=Eosinophils

Serum testosterone level: Results for serum testosterone level for 1st week, 2nd week and 3rd -week post-treatment (figure 4) revealed at the first week that there is a significant difference in the serum testosterone level of groups A and B compared to group C. The value is higher in group A followed by group B. It was observed that at the second week, there was no significant difference in the values of the serum testosterone levels compared to the control group. At the 3rd week, there was no significant difference in the serum testosterone levels in treatment groups A and B compared to the control group C.

Testicular biometry: The testicular biometry result for the first week (Table 11) revealed that the bodyweight value of group C which is the control group is non-significantly higher than those of groups A and B. There is also no significant difference statistically between the weight of the left testis, and right testis compared to that of the control group. There is also no significant difference between the lengths of the left testis and right testis and also the diameter of the left testis and right testis.

The result for the second week of testicular biometry (Table 12) revealed that there is no significant difference in all the parameters of the testicular biometry in the treated groups' A and C compared to the control group C.

The result for the third-week post-treatment (Table 13.) revealed that there was no significant difference in all the parameters of the testicular biometry in the treated groups' A and B compared to the control group C.

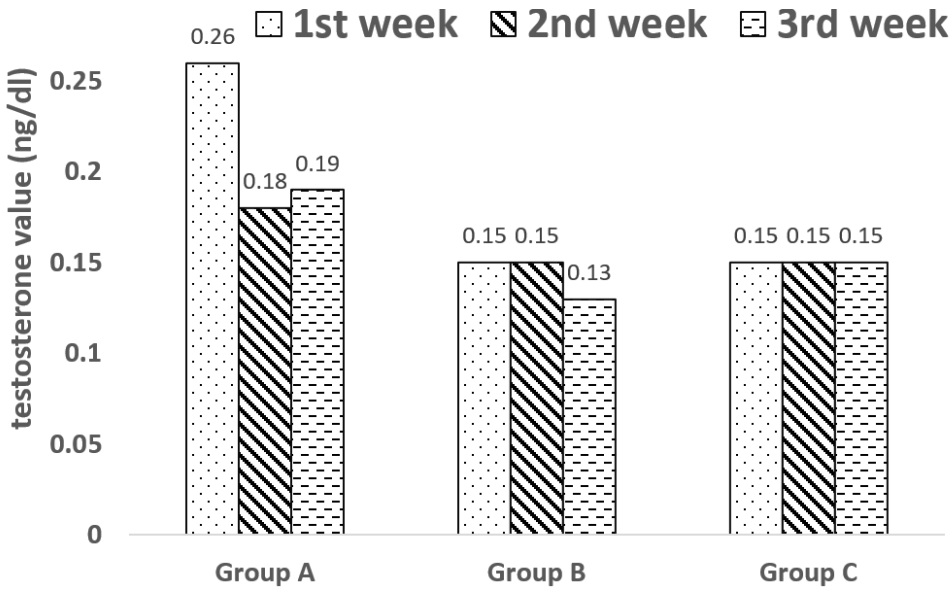

Figure 4
Serum Testosterone Level Results After the First, Second and Third Week of Treatment.

Table 11.
Bodyweight, Left Epididymal Weight And Testicular Biometry Results After First Week Of Treatment

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
Body Weight (g)	100.40±8.72 [a]	102.80±0.67 [a]	118.80±12.80 [a]	0.32	NS
Left Epididymis	0.12±0.02 [a]	0.16±0.02 [a]	0.16±0.05 [a]	0.57	NS
Left Testis Weight (g)	0.54±0.13 [a]	0.76±0.05 [a]	0.61±0.15 [a]	0.43	NS
Right Testis Weight(g)	0.67±0.09 [a]	0.77±0.05 [a]	0.62±0.16 [a]	0.62	NS
Left Testis Length (cm)	14.67±0.69 [a]	15.93±0.58 [a]	13.26±1.97 [a]	0.35	NS
Right Testis Length(cm)	14.97±0.74 [a]	15.82±0.37 [a]	13.64±1.54 [a]	0.34	NS
Left Testis Diameter	7.81±0.29 [a]	8.85±0.33 [a]	8.00±0.92 [a]	0.43	NS
Right Testis Diameter	8.26±0.56 [a]	8.99±0.22 [a]	8.05±0.89 [a]	0.55	NS

NS=Not significant, [abc]=Means in the same row with different superscript differ significantly($p<0.05$).

Table 12.
Body Weight, Left Epididymal Weight and Testicular Biometry Results After Second Week Of Treatment

Group	Group A	Group B	Group C	P-Value	Remarks
Body Weight (g)	131.80±10.29 [a]	106.00±3.46 [a]	118.80±12.80 [a]	0.21	NS
Left epididymis	0.21±0.03 [a]	0.13±0.02 [a]	0.16±0.05 [a]	0.25	NS
Left Testis Weight (g)	0.95±0.04 [a]	0.72±0.12 [a]	0.61±0.15 [a]	0.14	NS
Right Testis Weight(g)	0.94±0.04 [a]	11.59±10.85 [a]	0.62±0.16 [a]	0.39	NS
Left Testis Length (cm)	14.88±0.98 [a]	14.75±1.56 [a]	13.26±1.97 [a]	0.72	NS
Right Testis Length (cm)	14.88±0.98 [a]	14.75±1.56 [a]	13.64±1.54 [a]	0.63	NS
Left Testis Diameter	8.43±0.74 [a]	8.34±0.92 [a]	8.00±0.92 [a]	0.93	NS
Right Testis Diameter	8.59±0.85 [a]	8.36±0.92 [a]	8.05±0.89 [a]	0.91	NS

NS=Not significant, [abc]=Means in the same row with different superscript differ significantly(p<0.05).
The result for the third-week post-treatment (Table 13.) revealed that there was no significant difference in all the parameters of the testicular biometry in the treated groups' A and B compared to the control group C.

Table 13.
Body Weight, Left Epididymal Weight And Testicular Biometry Result After Third Week Of Treatment.

GROUP	GROUP A	GROUP B	GROUP C	P-VALUE	REMARKS
Body Weight (g)	114.89±3.75 [a]	108.87±7.24 [a]	118.80±12.80 [a]	0.73	NS
Left epididymis weight (g)	0.20±0.03 [a]	0.23±0.02 [a]	0.16±0.05 [a]	0.54	NS
Left Testis Weight (g)	0.85±0.08 [a]	0.89±0.07 [a]	0.61±0.15 [a]	0.21	NS
Right Testis Weight (g)	0.82±0.07 [a]	0.87±0.06 [a]	0.62±0.16 [a]	0.27	NS
Left Testis Length (cm)	16.43±0.57 [a]	17.47±0.59 [a]	13.26±1.97 [a]	0.11	NS
Right Testis Length (cm)	15.97±0.72 [a]	16.90±0.63 [a]	13.64±1.54 [a]	0.15	NS
Left Testis Diameter	9.33±0.33 [a]	9.64±0.31 [a]	8.00±0.92 [a]	0.19	NS
Right Testis Diameter	8.98±0.24 [a]	9.51±0.34 [a]	8.05±0.89 [a]	0.27	NS

NS=Not significant, [abc]=Means in the same row with different superscript differ significantly(p<0.05).

DISCUSSION

In haematology**,** it was observed that at the first-week post-treatment that there was a significant (p<0.05) decrease in the PCV and haemoglobin values of group A compared to group C which is the control group but the value later increased at the second week and third-week post-treatment. This may be due to the newness of the methanol extract in their system. Also, there was a significant decrease in the values of lymphocytes at the third week of both groups A and B compared to the control group C. The values obtained for RBC and showed non-significant effects in the treatment of rats with Methanol and Aqueous extracts of *Corchorus olitorius* on red blood cells (RBC) counts when compared with the control. This is an indication that there was no destruction of red blood cells and no change in the rate of production of RBC (erythropoiesis). This also shows that both the methanol and aqueous extracts of the plant do not have the potential to stimulate erythropoietin release from the kidneys, which is the humoral regulator of RBC production (Polenakovic and Sikole, 1996). The non-significant effects of the treatment of rats with 250mg/kg of both extracts also indicate that there was no change in the oxygen-carrying capacity of the blood and the amount of oxygen delivered to the tissues since RBC is very important in transferring respiratory gases (De Gruchy, 1976). It has been reported that values of RBC and associated parameters lower than normal ranges are indicative of anaemic conditions while higher values are suggestive of polycythemia (American Diabetes Association, 2000), thus, the treatment of rats with methanol and aqueous extracts of the plant may not have the potential to induce anaemia or polycythemia.

It was observed in the values for body weight, testicular and epididymal biometry that there was no significant (p≥0.05) difference in the body weight of the experimental animals during the period of the experiments. It was also observed that there is a non-significant difference in the weights of the left testes, right testes, the length of both the left and right testes and also the diameter of the testes in all the groups for the period of the experiments. There is also a non-significant difference in the weight of the left epididymis in the experimental groups compared to the control group.

In semen characteristics, there was a significant decrease in spermatozoa motility in the treated groups' A and B compared to the control group C at the first, second-and third-week post-treatments. This is in agreement with the treatment of male albino rats with ethanol extract of *Aegle marmelos* leaf (Chauhan and Agarwal, 2008).

It was observed that there was no significant difference in the spermatozoa morphology abnormalities in the experimental groups compared to the control group for the duration of the experiments

There is a significantly high value in the testosterone level in group A which was treated with methanol extract when compared to the control group at first-week post-treatment but there was no significant difference in the values at the second and third weeks. This is contrary to the reduction in the levels of serum testosterone level, reported when the crude methanol extract of *Quassia amara* was administered to male albino rats (Raji and Bolarinwa, 1997) and also when methanol extract of *Abelmoschus esculentus* fruit was administered to male albino rats (Olatunji-Bello *et al*., 2009).

In conclusion, the methanol and aqueous extracts of *Corchorus olitorius* leaves significantly decreased sperm motility in male albino rats. Therefore, prolonged use or administration of *Corchorus olitorius* could decrease male fertility. Meanwhile, its effect on human reproduction is not known but considering the findings in this study, infertile males undergoing fertility treatments are advised to take *Corchorus olitorius* plant with caution. Also, in this study, Methanol and Aqueous extracts of *Corchorus olitorius* leaves increased the Packed cell volume and Haemoglobin concentration and therefore can be used to treat anaemia in both animals and humans but with caution.

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