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## The Effect of Stem Bark Extracts of *Carapa procera* D.C Meliaceae on Hormonal and Biochemical Parameters in Male Albino Wistar Rats



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### ABSTRACT

Hormonal and biochemical imbalance could lead to male impotence and infertility worldwide. The inability of male to fulfill its biological and social responsibilities could lead to infidelity and divorce. The stem bark of *Carapa procera* was collected from the wild, dried and extracted using n-hexane, dichloromethane and 70% methanol. The yield obtained were 0.5, 0.83 and 1 percent for n-hexane, dichloromethane and 70% methanol fractions respectively while the crude extract yielded 4 percent. The acute toxicity test was determined using Lorke's method with an LD<sub>50</sub> of 447.21 mg/kg of the crude extract. The hormonal profile revealed that the dichloromethane fraction and the median dose of the crude extract potentiate the serum level of testosterone. However, the standard drug (testosterone), dichloromethane fraction and low dose of crude methanol extract suppress the plasma concentration of luteinizing hormone without affecting the plasma concentration of follicle stimulating hormone. The n-hexane fraction and median dose of the crude extract affect alanine aminotransferase by increasing the serum level at p<0.05 and 0.001 respectively, which is a sign of liver toxicity. The 70% methanol fraction significantly reduced serum concentration of alkaline phosphatase (ALP) at p<0.05 whereas the median dose of the crude extract significantly increases the plasma concentration of alkaline phosphatase. The dichloromethane and methanol fractions significantly decreased the plasma concentration of triglyceride at p<0.05. All the samples evaluated showed no effect on the plasma concentration of aspartate amino transaminase and high density lipoprotein. The increase in the plasma concentration of testosterone by the crude extract and dichloromethane fraction ratify the use of *Carapa procera* as an aphrodisiac agent in folkloric medicine.



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## INTRODUCTION

Infertility is considered as one of the global public health problems and in human history, it is considered as one of the unsolved problems of continuous human race<sup>1</sup>. Infertility is a disorder of the reproductive system which is defined as the failure of couple to have a clinical pregnancy after one year or more of regular unprotected sexual intercourse<sup>1,2</sup>.

Male hormonal and biochemical imbalance is a major cause of infertility worldwide resulting in the inability of the male to fulfill his biological and social responsibilities. Impotence could be due to psychogenic, endocrine, vascular disturbance, neurogenic disorders and medications<sup>1,3,4</sup>.

Hormones and enzymes play important roles in the body to bring about the desired physiological and biochemical effect at the receptor level. Testosterone, an hormone secreted in the testis, is responsible for male sexual characteristics such as; the development of male reproductive organs, sex drive, virilization and spermatogenesis<sup>5</sup>.

Low level of intratesticular testosterone could affect spermatogenesis and obstruction of the ductal system. Particularly the vas deferens has been reported as the causes of azoospermia. These could be due to infection of seminiferous tubules and vas deferens which affect the circulating level of follicle stimulating hormone (FSH), luteinizing hormone (LH), and testosterone<sup>6</sup>. Hormonal imbalance such as hyperprolactinemia could lead to impotence and male infertility<sup>7,8</sup>. Indeed, the root issues of infertility can be related to both sexes: approximately 50 percent of infertility is caused by female conditions, while approximately 40 percent is male related. It is also worth noting that in 25 percent of infertile couples both partners will have a fertility problem. In about one in a hundred infertile men the problem is caused by low levels of hormones made in the pituitary gland that act on the testes. Low production of FSH and LH can affect testosterone in the testes and lead to lower sperm production<sup>9,10</sup>.

*Carapa procera* D.C, is a medicinal plant commonly found in West Africa and belongs to the family of Meliaceae. It is used by the Ijaws in Niger Delta Region of Nigeria in the treatment of various ailments. The fruit kernel is used in the management of malaria and cough while the stem bark is used in ethnomedicine for the management of erectile dysfunction (ED) in men. This medicinal plant is commonly referred to as Monkey Cola, Ijaws call it *Obugodibia* or *Egbekum*, *Erere*, *Agogo*, *Abo-Oganwo* in Yoruba, *Mpaoku* in Igbo and *Abakang* in Efik<sup>11</sup>.

The increased rate of male impotence and infertility could lead to pandemonium, divorce and high rate of infidelity by married women. These prompted evaluation of the effect of stem bark extracts of *Carapa procera* on the male reproductive hormones, some selected biochemical and lipid profile in male wistar rats, to validate its use as an aphrodisiac agent in folkloric medicine.

## **MATERIALS AND METHODS**

### **MATERIALS**

All the reagents and chemicals were bought from reputable pharmaceutical companies and were of analytical grade.

### **METHODS**

#### **Collection of Plant and identification**

The plant was collected at Otabi Community in Ogbia Local Government Area of Bayelsa State. It was identified and authenticated by Mr. Emmanuel Chuwkuma at Forestry Research Institute of Nigeria, Ibadan and Herbarium number FHI 112975 was assigned to it.

#### **Processing of plant**

The stem bark was dried at room temperature for 28 days, grounded using mechanized grinder, weighed and stored in airtight container until extraction.

#### **Extraction**

About 3271 g of the powder stem bark was extracted successively using n-hexane, dichloromethane and 70% methanol (4x2.5L) respectively, for 7 days. The crude extract about 490 g of the powdered stem bark was extracted with 70% methanol filtered daily and a fresh solvent added for 7 days.

#### **Acute Toxicity Test (LD<sub>50</sub>)**

The LD<sub>50</sub> of the crude extract was determined using Lorke's method to assess the acute toxicity profile of the extract with an LD<sub>50</sub> of 447.21 mg/kg<sup>12,13,14,15</sup>.

## **Experimental Animals**

Forty eight matured male albino rats of about twelve weeks old weighing between 130-281 g were used for the experiment. They were kept in a well ventilated conventional cage 28-31°C, photoperiod of darkness 12 hours and 12 hours of natural light. The animals were allowed to acclimatize for two weeks and were fed on standard diet and had free access to water. The experiment was carried out according to the standard laboratory conditions as approved by the animals ethical committee of the University of Uyo<sup>15,16</sup>. The animals were divided into eight groups of six animals per group.

## **Hormonal and Biochemical Assay**

Based on the LD<sub>50</sub>, the crude extract was administered at a dose of 44.72, 89.44 and 134.16 mg/ kg and the fractions were given median dose (89.44 mg/kg) of the fractions were administered.

Group 1 and 2 was given 10 mL and 1 mg/kg of distilled water and testosterone respectively.

Group 3 to 5 were administered crude extract at 44.72, 89.44 and 134.16 mg/kg respectively.

Group 6-8 were given 89.44 mg/kg of n-hexane, dichloromethane and 70% methanol fractions daily for 7 days respectively. On the 8<sup>th</sup> day the animals were anaesthetized with chloroform and sacrificed. Blood samples were collected through cardiac puncture and were allowed to stand at room temperature for one hour and centrifuged at 2500 rpm for 5 minutes to separate the serum. The serums were transferred using micropipette into test tubes and were stored at -20°C in a refrigerator until the assay was done<sup>16,17,18</sup>. The samples were determined using standard procedures for testosterone, follicle stimulating hormone (FSH), luteinizing hormone (LH) and prolactin<sup>19</sup>. Biochemical assay includes; Aspartate amino transaminase (AST), alanine amino transaminase (ALT) and alkaline phosphatase (ALP) while lipid profile; total cholesterol (TC), triglyceride (TG) and high density lipoprotein (HDL) were assessed using standard procedures<sup>18,20,21</sup>.

## **Statistical analysis**

The results obtained were expressed as multiple comparisons of Mean±S.E.M. Significance was determined using one-way ANOVA followed by Tukey Kramer multiple comparison post test with a  $p < 0.05$  is considered significant<sup>19</sup>.

**RESULTS**

**Table No. 1: Result of Hormonal Profile of Stem Bark Extracts of *Carapa procera***

Sample	TET	PRL	LH	FSH
VEH	1.23±0.22	1.15±0.07	1.31±0.09	0.68±0.07
STD	3.00±0.74 <sup>a</sup>	1.13±0.19	0.84±0.09 <sup>a</sup>	0.61±0.07
LD	1.66±0.34	1.20±0.27	0.83±0.12 <sup>a</sup>	0.45±0.05
MD	3.36±0.37 <sup>b</sup>	1.29±0.05	1.17±0.11	0.59±0.07
HD	2.13±0.34	1.10±0.22	0.84±0.09	0.72±0.13
n-Hex	1.35±0.12	1.06±0.04	1.21±0.13	0.61±0.06
DCM	3.95±0.43 <sup>c</sup>	1.08±0.19	0.83±0.08 <sup>a</sup>	0.413±0.06
MT	1.79±0.21	1.04±0.05	1.30±0.12	0.615±0.07
Values represent Mean±S.E.M				

Significance related to control were considered at <sup>a</sup>p<0.05; <sup>b</sup>p<0.01; <sup>c</sup>p< 0.001.

(n=6)

**Keys;** TET = Testosterone, PRL= Prolactin, FSH =Follicle Stimulating Hormone LH = Luteinising Hormone. VEH= Distilled water, STD=Standard drug (Testosterone), LD = Low Dose Crude Extract (44.72 mg/kg), MD = Median Dose Crude Extract (89.44 mg/kg), HD = High Dose Crude Extract (134.16 mg/kg), n-Hex = n-Hexane fraction (89.44 mg/kg), DCM = Dichloromethane fraction (89.44 mg/kg) and MT = 70% Methanol fraction(89.44 mg/kg).

**Table No. 2: Result of biochemical profile of stem bark extracts of *Carapa procera***

Sample	AST	ALT	ALP	TC	TG	HDL
VEH	36.83±3.22	11.77±0.92	39.00±1.07	2.60±0.07	1.42±0.10	0.79±0.02
STD	29.67±6.62	11.47±0.39	49.67±2.57	2.48±0.14	1.42±0.10	0.79±0.02
LD	36.83±1.87	10.32±0.71	48.33±2.19	2.47±0.18	1.22±0.22	0.70±0.13
MD	41.17±0.95	16.52±0.75 <sup>c</sup>	50.67±2.58 <sup>a</sup>	2.52±0.08	1.54±0.11	0.89±0.02
HD	36.50±1.41	9.40±0.22	31.33±2.32	2.38±0.14	1.59±0.08	0.89±0.04
n-Hex	41.17±1.08	14.38±0.33 <sup>a</sup>	46.67±4.45	2.37±0.12	0.97±0.02	0.99±0.06
DCM	36.83±2.52	13.23±0.39	44.50±1.06	2.37±0.19	0.87±0.06 <sup>a</sup>	0.94±0.03
MT	41.33±1.20	11.57±0.22	27.50±0.76 <sup>a</sup>	2.35±0.08	0.88±0.02 <sup>a</sup>	0.88±0.08
Values represent Mean±S.E.M						

Significance related to control were considered at <sup>a</sup>p<0.05; <sup>b</sup>p<0.01; <sup>c</sup>p< 0.001.

(n=6)

## DISCUSSION

The yield obtained were 0.5, 0.83 and 1.0% for n-hexane, dichloromethane and 70% methanol fractions respectively, while the crude extract yielded 4%. The acute toxicity test was determined using the Lorkes method with an LD<sub>50</sub> of 447.21 mg/kg of the crude extract.

Testosterone, FSH, LH and prolactin evaluation are useful in the management of male infertility<sup>22</sup>. Exposure to excess corticosteroid either endogenously or exogenously could result to decrease spermatogenesis. An elevated plasma cortisone level depresses LH secretion and induces secondary testis failure<sup>23</sup>. High plasma prolactin usually results in decreased FSH, LH and testosterone levels. This causes infertility associated symptoms which include; loss of libido, impotence, galactorrhea and gynaecomastia<sup>18</sup>. In the present study, there is an increase plasma testosterone in the positive control group (standard drug) at p< 0.05 which is significant when compared to the negative control (distilled water). The median dose of the crude extract significantly potentiates the serum level of testosterone at p<0.01 while the dichloromethane fraction which is very significant at p< 0.001 compared to negative control because it enhanced the plasma level of testosterone, this could be due to the presence of steroidal triterpenes. The testosterone (Standard drug) and dichloromethane fraction concomitantly suppresses the plasma level on luteinizing hormone due to negative feedback inhibitory mechanism at p <0.05. However, the low dose of 70% methanol crude extract significantly suppresses LH at p< 0.05 without affecting plasma testosterone level.

Biochemical evaluation of AST, ALT and ALP (Table 2) showed that the crude extract and fractions screened does not affect the serum AST. However, the median dose of the crude extract and n-hexane fraction significantly increased the serum level of ALP at p<0.001 and 0.05 respectively which is a sign of liver toxicity or hepatitis<sup>5</sup>.

The median dose of the crude extract significantly increased the plasma level of ALP at p<0.05 which is a sign of obstruction of biliary tract and infiltrative disease of the liver; granulomas and could be a sign of bone disease such as rickets, osteomalacia and hyperparathyroid. The 70% methanol fraction significantly decreases the plasma level of ALT with p<0.05. This effect was not observed at low and high dose of the crude extract. Dichloromethane and n-hexane fractions significantly altered plasma ALT.

The crude extract of the stem bark does not significantly affect the total cholesterol level because it is a useful intermediate biologically for the biosynthesis of testosterone<sup>19</sup>. However, dichloromethane and 70% methanol fraction significantly decreased the total glycerol at  $p < 0.05$  when compared to negative control and standard drug (testosterone). The crude extract does not affect serum level of HDL which is beneficial and protect the vessels against formation of plaques. The clinical importance of elevated triglyceride as lipoprotein is that it promotes the development of atherosclerosis which will result in the formation of thrombosis and infarction which is a leading cause of death<sup>24</sup>. Hyperlipoproteinaemia refers to disorder of elevated plasma lipoprotein while hyperlipidemia (hypertriglycendaemia refers to disorders of elevated plasma triglycerides). The dichloromethane extract significantly decreases plasma triglyceride with a  $p < 0.05$ . This could be used in the management of hypertriglycendaemia<sup>24</sup>.

## CONCLUSION

*Carapa procera* D.C Meliaceae has the potential to elevate the serum level of testosterone, this ratify its use as aphrodisiac agent in ethnomedicine. It also suppresses the plasma level of LH which could be due to negative feedback inhibition. The extract induces the alteration of liver enzyme in the plasma due to liver toxicity. The total cholesterol and HDL are not affected by administration of crude extract and fractions. The dichloromethane and 70% methanol significantly suppress the plasma triglyceride.

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## REFERENCES

1. Jaradat N, Zaid AN. Herbal remedies used for the treatment of infertility in males and females by traditional healers in the rural areas of the west bank/Palestine. BMC Complimentary and Alternative Medicine 2019; 19, 194.
2. Sullivan EA, Zegers-Hochschild F, Mansour R, Ishihara O, de Mouzon J, Nygren K, Adamson G. International Committee for Monitoring Assisted Reproductive Technologies (ICMART) world report: assisted reproductive technology 2004. Human Reproduction. 2013; 28:1375–90.



3. Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, regional, and global trends in infertility prevalence since 1990: a systematic analysis of 277 health surveys. *PLoS Med.* 2012; ;9:e1001356.
4. Lee M. Erectile Dysfunctions pp 1515-1533. In: *Pharmacotherapy: A Pathophysiologic Approach*, 6<sup>th</sup> Ed., Dipiro, J. T., Talbert, R. L., Yee, C. G., Matzke, G. R., Wells, B. G and Posey, L. M. McGraw-Hill Companies Inc, Newyork, 2005; 1515-1533.
5. Collier JD, Webster G. Liver and biliary tract disease. In: *Davidson's Principles and Practice of Medicine* 21<sup>st</sup> Ed. Colledge NR, Walter BR, Ralston SH (editors). Churchill Livingstone, Elsevier, Newyork, 2010; 1377p.
6. Abarikwu SO. Causes and risk factors for male infertility in Nigeria: A review *African Journal of Reproductive Health.* 2013; 17(4): 150-165.
7. Katz DJ, Teloken P, Shoshany O. Male infertility the other side of the equation. *AFP*, 2017; 46(9): 641-646.
8. Sharma A. Male infertility, evidences, risk factors, diagnosis and management in Human. *Annals of Clinical and Laboratory Research.* 2017; 5(3): 188.
9. Kashani L, Akhondzadeh S. Female infertility and herbal medicine, *Journal of Medicinal Plants.* 2017; 16(61): 1-7.
10. Healthy Male Andrology Australia, Australian Government Department of Health. [www.healthymale.org.au](http://www.healthymale.org.au), 2018; 1-46.
11. Odugbemi T, Akinsulire O. Medicinal plants pictures. In: Odugbemi, T. (editor) *Outlines and Pictures of Medicinal Plants from Nigeria*. University of Lagos Press, Nigeria. 2006; 163-255p.
12. Lorke DA. New approach to practical acute toxicity testing. *Archives of Toxicology*, 1983; 54, 275 - 287.
13. Okokon EJ, Udoh EA, Frank GS, Udo MN. Anti-inflammatory and Antipyretic Activities of *Panicum Maximum*. *African Journal of Biomedical Research.* 2011; 14: 125 - 130.
14. Chinedu E, Arome D, Ameh ESA. New method for determining acute toxicity in animal models. *Toxicol International.* 2013; 20(3): 224-226.
15. Dumaro CA, Etim E, Ahmadu AA. (2017). Anti-inflammatory constituents of *Randia hispidia*, K. Schum Rubiaceae. *Journal of Chemical and Pharmaceutical Research.* 2017; 9(2): 160-164.
16. Ngwu OE, Okoye JI. Comparative evaluation of selected medicinal plants on fertility indices (Reproductive Hormones and Sperm profile of albino wistar rats: Animal case study). *International Journal of Plants and Soil Science.* 2019; 29(2): 1-6.
17. Etuk EU, Mohammad AA. Fertility enhancing effects of aqueous stem bark extract of *Lophira lanceolata* in male Spargue dawley rats. *International Journal of Plant Physiology and Biochemistry.* 2009; (1): 001-004.
18. Najam W S. Significant value of hormonal assays as marker for male infertility in Tikrit City. *Tikrit Medical Journal.* 2012; 18(2): 314-321.
19. Idiogun SE, Obukohwo EA. Hormone Assays. In: *A Handbook of Techniques in Experimental Pharmacology.* Ozolua RI, Bafor EE (Editors). Mindex Publishing Company Limited. 2019; 294-302p.
20. Idiogun, SE and Obukohwo, EA. Clinical Enzyme Assays. In: *A Handbook of Techniques in Experimental Pharmacology.* Ozolua, R.I and Bafor, E.E (Editors). Mindex Publishing Company Limited. 2019; 305-312.
21. Nwafor PA. My interswitch from fertility regulating plants (contraceptives to Aphrodisiac), 69<sup>th</sup> Inaugral lecture of the University of Uyo, Uyo. University of Uyo Press Limited, University of Uyo. 2019; 156p.
22. Babu SR, Sadhnani MD, Padmavathi,P and Reddy PP. Evaluation of FSH, LH and Testosterone levels in different subgroups of infertile males. *Indian Journal of Clinical Biochemistry.* 2004; 19(1): 45-49.
23. Rey R, Lordereun RI, Carl JC, Barbet P, Cate RL, Roger M. Antimullerian Hormone and Testosterone serum levels are inversely related during normal and Precocious Pubertal development. *Journal of Clinical and Endocrinology Metabolism.* 1993; 77, 1220-1226.
24. Akubue PI. Drugs used in the treatment of hyperlipidaemia. In: *Textbook of Pharmacology*, Akubue, P.I Africana First Publishers Limited, Onitsha, 2005; 212-220.



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