



CONTENTS

RESEARCH ARTICLES

1. Assessment of secondary metabolites and bioefficacies of *Peltophorum pterocarpum* (DC.) Baker ex K. Heyne cell cultures 265-271
Satish C. Jain, Boskey Pancholi and Renuka Jain
- *2. Physiological response of West African dwarf goats to graded levels of *Tribulus terrestris* extract 273-277
K.M. Okukpe, A.A. Adeloye, O.I. Alli, M.A. Belewü and O.A. Adeyina
3. Micronutrient contents in leaves of poppy cultivars grown with different boron doses 279-282
Özden Öztürk, Hakan Günlü and Sait Gezin
4. Preliminary phytochemical screening and evaluation of hypoglycemic activity of *Tinospora cordifolia* in alloxan induced diabetic rats 283-287
V. Sivakumar and M.S. Dhana Rajan
5. Spectrophotometric determination of antioxidant potential of selected *Acacia* species 289-292
C.T. Sulaiman, V.K. Gopalakrishnan and Indira Balachandran
6. Antibacterial activity of five oil bearing Ethiopian medicinal plants against eleven pathogenic bacterial strains 293-299
Getachew Belay, Yinebeb Tariku, Tadesse Kebede, Ariaya Hymete and Yalemtehay Mekonnen
7. *Allium sativum* L. extract feeding changes the haematological patterns in female albino rats 301-305
Sashank Srivastava and Param Hans Pathak
8. Potency of a flavonoid isolated from *Artocarpus altilis* (Parkinson) Fosberg in inhibition of platelet aggregation in hyper-aggregative subjects 307-310
Tjandrawati Mozef, Andreanus A. Soemardji, Elin Y. Sukandar and Heni Rachmawati
9. Variations in essential oil composition and biological activity of *Hyptis suaveolens* Poit: A high value aromatic plant of the Himalaya 311-314
Hema Lohani, Harish Chandra Andola and Nirpendra Chauhan

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Physiological response of West African dwarf goats to graded levels of *Tribulus terrestris* extract

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ABSTRACT

Thirty West African dwarf bucks with average initial weight of 10kg were used in the experiment to investigate the effect of varying levels of *Tribulus terrestris* extract on their sexual response. The extract was administered subcutaneously in different doses (0.01, 0.02 and 0.03ml/kg Bw), while the control and standard groups were given 0.01ml/kg saline solution and sildenafil citrate, respectively. The administration of *Tribulus terrestris* extract at different doses had varying effect on the haematological, biochemical and physiological indices of West African dwarf bucks. Results of the present study showed that subcutaneous administration of 0.02ml/kg body weight of bucks with *Tribulus terrestris* extract had sustained increase in sexual activity with no conspicuous adverse effects and toxicity with regards to the serum biochemical and haematological parameters of WAD bucks, and their health status were not compromised. [Medicinal Plants 2011; 3(4) : 273-277]

Keywords : *Tribulus terrestris*, bucks, extract, libido, West African dwarf goats

INTRODUCTION

Sperm output depends on a number of factors which include age, species, season, scrotal size, frequency of ejaculation and degree of sexual preparation. The degree of sexual preparation is influenced by the production of testosterone by the interstitial cells (Leydig cells) of the testis. Testosterone production is regulated by luteinizing hormone (LH) which acts on the Leydig cells.

Tribulus terrestris, a taprooted prostrate herbaceous perennial plants widely distributed in Southern Nigeria, is being promoted as a booster for the purpose of increasing sex drive, sperm output and quality. Its extract has been suggested to slightly increase hormone levels, leaving them in the normal range (Brown *et al.*, 2000). It has also been shown to enhance sexual behavior in animal model by stimulating androgen receptors in the brain (Gauthaman *et al.*, 2008).

Different studies in goats, rabbits and primates have demonstrated significant increase in levels of testosterone, dihydrotestosterone and dehydroepiandrosterone (DHEA) and produces effects suggestive of aphrodisiac activity when administered the seed extracts (Gauthaman *et al.*, 2002; Gauthaman and Ganesan, 2008). *Tribulus terrestris* enhance mounting activity and erection better than testosterone cypionate in mice.

There are contrary reports that it has consistently failed to increase testosterone levels in controlled studies (Brown *et al.*, 2000, 2001; Neychev and Mitev, 2005). It has also failed to demonstrate strength-enhancing properties (Rogerson *et al.*, 2007). Another study found that a commercial supplement containing androstenedione and herbal extracts including *Tribulus terrestris*, was no more effective on raising testosterone levels than androstenedione alone (Brown *et al.*, 2000) showing that the inclusion of *Tribulus terrestris* did not enhance the effectiveness of the supplement. Therefore, the present study has been done to determine the aphrodisiac effect of *Tribulus terrestris* extract on West African dwarf goats.

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MATERIALS AND METHODS

Preparation of extract

Tribulus terrestris plants were collected from Ilorin metropolis, Kwara State, Nigeria, and were identified using the University of Ilorin herbarium. The seeds were air-dried, picked to remove dirt, ground to powder and packaged in cellophane bag for extraction. The extraction of the active substance was carried out with a modified method of Swain (Swain, 1999) with 96% ethanol at 75-80°C in a soxhlet apparatus for four hours. At the end of the extraction, the liquid extract was filtered using Whatman filter paper. The filtrate was concentrated under reduced pressure in a vacuum dessicator at 30°C for 25 minutes using a rotary evaporator to obtain a dark brown mass. The resulting residue was transferred to a hot air oven where it was dried to a constant weight at 45°C. Subsequently, 5g of the extract was dissolved in 250ml of saline water to obtain appropriate concentrations suitable to achieve a 0.5ml dose by volume of extract which was later administered subcutaneously to the bucks for a period of seven days.

Management of animals

Thirty West Africa Dwarf bucks of the same age between 1 to 2 years were purchased within Ilorin metropolis. These bucks were quarantined for 14 days. During this period, the bucks were given oxytetracycline R, vitamin and ivermectin R injection to relieve them from stress, external and internal parasites. The bucks were vaccinated against peste des petite ruminantum (PPR) infection before the commencement of the experiment. The bucks were weighed, their heart beat and pulse rate as well as rectal temperature were taken and recorded for the period of the experiment. Blood samples were collected before, during and after the experiment. Animals were housed in individual pen with slatted floor. Wooden troughs and plastic bowls were provided for feeding and watering respectively.

Feed (Table 1) was formulated to meet the basic nutrient requirements of the bucks and they were fed 300g per day throughout the experimental period. *Panicum maximum*, *Gliricidia sepium* and water were provided *ad-libitum*.

Experimental procedure

The experiment has been done on a complete randomized design. Animals were randomly assigned into five groups of six animals per treatment.

Animals in group A (control) and B (standard) were given normal saline and sildenafil-citrate drugs respectively, while animals in groups C, D, E were given 0.01, 0.02 and 0.03ml/kg *Tribulus terrestris* extracts respectively for seven days.

Statistical analysis

Data on performance indices (Red Blood Cell, White Blood Cell, Packed Cell Volume and Haemoglobin) and biochemical parameters (Total protein, Albumin and Serum testosterone) were analyzed using the analysis of variance (ANOVA) procedure following a completely randomized model with the COSTAT programme. The levels of significance were determined using the Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Table 2 shows the physiological parameters of the experimental animals. Animals in Group B, C, D treated with 0.01ml Sildenafil-citrate, 0.01 and 0.02ml/kg of *Tribulus terrestris* extract respectively, showed regular display of sexual activity (aggressiveness), attempt to mount on the third and fourth day of administration, while only group D successfully mounted on the fourth day, the others mounted on the seventh day of administration of extract. The heart-beat and pulse rate were close in groups B, A, D and C, though not significant. There was significant differences ($p < 0.05$) in temperature which seems to increase as the level of

Table 1. Composition of experimental feed

Ingredients	Percentage inclusion
Maize	30
Groundnut Cake	14
Wheat Offal	33
Salt	1
Premix	0.25
Rice Bran	10
Limestone	1
Bone	0.75
Palm Kernel Cake	10
Nutrient Contents are	
Energy (cal)	2257.48
CP	17.30
CF	7.04
Ash	4.7

Table 2. Effect of *Tribulus terrestris* on some physiological indices of West African Dwarf Bucks

Physiological indices	A 0.01 ml/kg BW with normal saline	B 0.01 ml/kg BW with sildenafil citrate	C 0.01 ml/kg BW with Tt extract	D 0.02 ml/kg BW with Tt extract	E 0.03 ml/kg BW with Tt extract	SEM
1 st Day of experiment						
Heart beat	118 ^{ab} /69	154 ^a /85	87 ^b /46	97 ^b /65	94 ^b /60	± 738.467 572.867
Pulse rate	68.30	69.30	71.30	69.00	71.30	± 69.667
Rectal temp., °C	38.20 ^b	38.50 ^{ab}	39.10 ^a	39.00 ^{ab}	39.00 ^{ab}	± 0.189
4 th day of experiment						
Heart beat	126/84	131/83	103/63	105/62	92/61	± 614.600 1018.867
Pulse rate	73.00	69.00	70.00	73.00	70.00	± 52.733
Rectal temp., °C	37.80 ^b	38.50 ^{ab}	39.20 ^a	39.10 ^a	39.00 ^a	± 0.396

Tt - *Tribulus terrestris*; BW - Bodyweight; SEM - Standard error of the mean,
a,b - means in the same row with different superscripts differ significantly (P<0.05).

Table 3. Effect of *Tribulus terrestris* on haematological/biochemical parameters of West African Dwarf Bucks

Haematological indices	A 0.01 ml/kg BW with normal saline	B 0.01 ml/kg BW with sildenafil citrate	C 0.01 ml/kg BW with Tt extract	D 0.02 ml/kg BW with Tt extract	E 0.03 ml/kg BW with Tt extract	SEM
Hb, g/dl	6.10	9.80	10.10	9.80	10.20	± 0.018
PCV, %	18.00	29.00	30.00	29.00	30.00	± 0.025
RBC, $\times 10^6/\text{mm}^3$	2.10	2.60	2.80	2.80	2.40	± 0.088
WBC, $\times 10^3/\text{mm}^3$	6.80	6.90	11.50	11.80	5.60	± 0.119
MCV, fl	104.00	112.00	107.00	104.00	125.00	± 0.080
MCH, pg	35.00	38.00	36.00	35.00	42.00	± 1.533
MCHC, %	33.50	34.00	34.00	34.00	34.00	± 0.316
PLAT, /mm ³	930.0	923.0	875.0	630.0	821.0	± 175.2
NEUT, /mm ³	62.00	16.00	6.00	4.00	12.8	± 0.808
LYMPH, %	32.00	75.0	71.2	72.2	69.2	± 8.70
Total protein, g/dl	52.93	70.03	74.23	77.13	72.03	± 0.080
Albumin, g/dl	36.03	37.03	37.97	38.87	37.97	± 0.11
Testosterone	1.20	1.40	1.30	1.40	1.20	± 0.04

Tt - *Tribulus terrestris*; BW - Bodyweight; SEM - Standard error of the mean,
a,b - means in the same row with different superscripts differ significantly (P<0.05).

extract increases. The results of the effects of *Tribulus terrestris* on haematological and biochemical parameters of West African Dwarf bucks are shown in Table 3. Haemoglobin concentration (Hb), Packed Cell Volume (PCV), Erythrocyte counts (RBC) and white blood cell count (WBC), though not significantly different seems to follow a definite trend. It increases as the level of extract is increased, to reach its maximum at 0.02ml/kg extract after which it reduces. The differential blood count shows an increase in lymphocyte production with increasing extract, though not significant. The serum total protein, albumin and testosterone follows a definite trend, though not significant as they increase with increasing level of extract and start reducing at 0.3ml/kg BW with further increase in extract level.

There was no significant differences ($p > 0.05$) in heart-beat, pulse-rate and temperature in all the groups, this shows that *Tribulus terrestris* has no deleterious effect on the physiological well-being of West African Dwarf bucks at doses of 0.01-0.03ml/kg BW. This supports the work of other authors that *Tribulus terrestris* slightly increase hormone levels, leaving them in the normal range and does not have negative effect on body functions (Supplement watch, 2006).

Haemoglobin concentration was highest in group E (0.03ml extract), followed by group C and lowest in group A (control). The value in group D (0.02ml) was similar to that of group B (Sildenafil-citrate). This could be the reason for its long use as a constituent of tonics in traditional medicine (Ayurvedic Pharmacopoeia of India, 2001). The observed increase in Hb, PCV and RBC could be attributed to its health and medicinal effects of three groups of active phytochemicals (dioscin, protodioscin and diosgenin) present in the *Tribulus terrestris* extract. This supports the work of Brown *et al.* (2000) and Rogerson *et al.* (2007) that *Tribulus terrestris* extract could be used as a tonic to improve blood production, circulation and build body muscles. *Tribulus terrestris* extract help to regulate sexual energy levels and sexual strength by increasing the percentage of free available testosterone levels for men and also affect pregnenolone, progesterone and estrogen. The hormone balancing ability of *Tribulus terrestris* in the body of women also account for the use of the herb in connection with premenstrual and menopausal syndrome (Gauthaman *et al.*, 2002, 2008). It also contain sterols such as betasitosterols and stigma which helps to protect the prostate gland from swelling, and in combination with the steroidal saponins may help to protect the prostate gland from cancer (Anthonio, 2000).

The white blood cell counts (WBC) were significantly different in all the treatment due to increased production of leucocytes, which might have been produced and mobilized for defensive actions. Schalm *et al.* (1975) reported that leucocytes exercise their function as free macrophages in the tissue in defense against microbial agents. Monocytes for instance have a great ability for phagocytosis or pinocytosis. The highest production of white blood cells was in group D, showing that it had the highest effect on the physiological function of the animal.

Serum total protein and albumin followed the same trend with the highest value in group D (0.2ml extract). The total serum protein increased as the level of extract is increased but reduces at the highest dosage of 0.03ml/kg bodyweight. *Tribulus terrestris* improve total serum protein as a result of the presence of amino acids, sterols, phenols, alkaloids and helps to increase the tissue contents of Na and Cl ions (Wessinger, 1985; Olajide *et al.*, 1999).

Serum albumin level seems to increase with increasing level of *Tribulus terrestris* extract suggesting that the animals had good clotting ability of the blood and adequate ability to prevent haemorrhage (Robert *et al.*, 2000). It could be observed that serum testosterone seems to increase with increasing level of extract, and reached its peak at 0.02ml/kg body weight, though not significant. The regular display of sexual activity by animals, administered the extracts, with the successful mounting and intromission of those administered 0.02ml/kg supports the work of different researchers that *Tribulus terrestris* enhance sexual behavior by stimulating androgen receptors in the brain and enhance mounting activity and erection (Gauthaman *et al.*, 2002; Gauthaman and Ganesan, 2008).

CONCLUSION

The study indicate that subcutaneous administration of 0.02ml/kg BW of *Tribulus terrestris* extract increase sexual drive (libido) in WAD bucks, which confirms the report of various workers that *Tribulus terrestris* has aphrodisiac power, improve male sexual performance, enhance sexual behavior and slightly increase hormone levels, leaving it in the normal range. Thus, the aphrodisiac activity of the extract might be attributed to its nervous stimulating property, and also lends support to the claims for its traditional usage as sexual function enhancing herbal medicine.

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