

ASSESSMENT OF REPRODUCTIVE PERFORMANCE OF KANO BROWN GOATS USING ETHANOLIC EXTRACT OF *Crossopteryx febrifuga* STEMBARK AS SYNCHRONIZING AGENT

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Received 14th February, 2022 Accepted 15th June, 2022

ABSTRACT

This study was conducted to determine the reproductive performance of Kano brown goats using ethanolic extract of *Crossopteryx febrifuga* (stembark) as synchronizing agent. A total of twenty-five kano brown does were used in the study. The does were randomly allocated to five treatments and replicated five times in a completely randomized design. The five treatment groups were T₁, T₂, T₃, T₄ and T₅. One buck was assigned to each treatment group. The T₁ serves as control and was not administered with the extract, while the remaining treatment groups 2, 3, 4 and 5 were administered with 5% *Crossopteryx febrifuga* extract through intravenous, oral, subcutaneous and intramuscular routes. The photochemistry revealed Alkaloids (4.13%), Flavonoids (1.96%), Saponins (1.05%), Tannins (2.11%), Steroids (6.54%) and Phenols (2.34%), while Glycosides and Terpenoids were not detected. Of the 20 does, three (3) does exhibited heat within 24-48, 6 in 48-72 hours, 4 between 72-96 hours and 2 expressed heat within 96 -120 hours after *Crossopteryx febrifuga* (Stembark) extract administration. The estrus response rate and conception rate were 100, 60, 40 and 100% and 80, 60, 20 and 80% for intravenous, oral, subcutaneous and intramuscular routes respectively. Significant positive correlations were found between estrus and concentration ($P < 0.01$), calculated doses and concentration ($P < 0.01$), calculated doses and estrus ($P < 0.01$), body condition score and estrus ($P < 0.01$). It was concluded that goat exhibited good response rate in the presence of steroid which has synchronizing ability and are capable of inducing heat and regulate the female reproductive cycle. Intravenous and intramuscular routes of administration are recommended for ethanolic extract of *Crossopteryx febrifuga* (stem bark) for Kano brown goats

Keywords: *Crossopteryx febrifuga*, Steroids, ethanolic extract, goat

INTRODUCTION

Synchronization of estrus implies the manipulation of estrous cycle or induction of estrus to bring large percentage of a group of females into estrus at a short, predetermined time (Odde, 1990). It focuses on the manipulation of either the luteal or the follicular phase of the estrous cycle. In does and ewes, the opportunity for control is greater during the luteal phase, which is of longer duration and more responsive to manipulation (Denwick, 2002). Strategies can be employed to extend the luteal phase by supplying exogenous progesterone or to shorten this phase by prematurely regressing existing corpora lutea (CL) (Wildevs, 2000). Synchronization of estrus programs provide several advantages e.g. permits parturition to occur at suitable times in

order to take advantage of feed and labor, availabilities, markets, and increasing price trends (Safdarian *et al.*, 2006). Furthermore, it also enable better estrus detection, shortening of kidding intervals, concentration of kid crop, improved management of pregnant does, induction of puberty in doe and the more efficient use of labor and animal facilities (Rahman *et al.*, 2008; Abecia *et al.*, 2012). It also facilitates reproductive management and AI in dairy goats. Sheep and goats are one of the most prominent seasonal breeders among the domestic animals. One of the major factors having an impact on today's small ruminants' industry that will ensure its future success and long-term sustainability is reproductive performance. However, for the industry to remain competitive and to continue growing to

meet the needs of consumers, it would be beneficial for producers to employ advanced reproductive technologies that improve efficiency and ultimately lead to an increase in flock productivity. By doing so, producers will be able to enhance their production in terms of percent lamb and kid crop produced by a flock per year (National Research Council, 2008). However Successful techniques must not only establish tight synchrony, but also provide an acceptable level of fertility upon natural mating or artificial insemination.

Several hormonal protocols have been employed by different researchers. These include prostaglandin $f2\alpha$ ($PGf_{2\alpha}$) and progesterone (Campbell *et al.*, 2003). Progesterone releasing devices such as synchro mate B", controlled internal drug release and progesterone releasing intravaginal device but, almost all the protocols are expensive and therefore searching for new assisted-reproductive technologies (ARTs) is necessary to enable concentrated breeding that ensures uniform kid crop and proper management of pregnant does. This work was strictly designed to study the reproductive performance of Kano brown goats using Ethanolic extract of *Crossopteryx febrifuga* (Stembark) as a synchronizing agent administered via different routes.

MATERIALS AND METHODS

The Study Area

The experiment was conducted in Bilyaminu Usman Polytechnic Farm Hadejia, located in Hadejia Local Government Area of Jigawa State. It is located on Latitude 12.27° 12.49° N and Longitude 10.04° 28.14° E. Annual rainfall ranging from 700 to 800mm, temperature ranging from 31°C to 40°C , it has two seasons (ie dry season 6-8 months and rainy season about 4months).

Experimental Animals, Plant Collection and Identification

Thirty sexually matured kano brown goats were used for the experiment (25 does and 5 bucks). The animals aged one year for does and one and half years for bucks, were obtained from a reputable sources within Jigawa state. The animals were allowed to acclimatize for two weeks prior to the commencement of the study and during this period they were vaccinated against pest de petit ruminant (PPR) Multivitamins, Antibiotics and Ivermectin injection were administered. Adequate fed and water was given ad-libitum. The animals were

managed intensively throughout the study. The ages of the animals were determined through dentition (Geoff, 2016). *Crossopteryx febrifuga* was collected within the University Community and identified by staff from the Department of Forestry and Wildlife of the University.

Method of Extraction and Screening of the Extract

The powdered leaves (144 g) were extracted using 95% methanol (3.0L). The fine powder from the leaves was weighed using digital weighing balance and then extracted using **Soxhlet extractor**. On extraction with 95 % methanol (3.0L) a syrupy green residue was obtained. A dark-green residue was obtained after it was allowed to evaporate in the oven at a temperature of 50°C . Thus, the required dose and concentration to be administered were calculated. The obtained extract was screened for its phytochemical properties such as Alkaloids, Flavonoids, Glycosides, Tannins, Saponins, Steroids, Phenols, and Terpenoids using standard procedure (Trease and Evans, 2000)

Test for Saponins

Three (3) ml of the aqueous solution or extract was mixed with 10 ml of distill water in a test tube, and was shaken vigorously for about 5 minutes and allow to stand for 30 minutes. The presence of honeycomb froth indicates the presences of Saponin.

Test for Terpenoids

A little amount of the extract was dissolve in Ethanolic and 1ml of acetic anhydrate was added, followed by the addition of concentrated tetra-oxosulphate (vi) acid (H_2SO_4). A color change from pink to violet indicates the presence of terpenoids. The color change was not detected.

Test for Flavonoids

A small quantity of the extract was dissolved in water and then filter, 2ml of 10% aqueous sodium hydroxide was added and the mixture produced a yellow coloration, diluted (HCL) was added. A Change of color from yellow to colorless indicates the presence of flavonoids.

Test for Alkaloids

0.5g of the extract was stirred with 5ml of 1% aqueous hydrochloric acid (HCL) on water bath and filtered. 3ml of the filtrate was divided into 3 test tubes equally. To the first portion, few drops of dragendorff's reagent were added, and an orange red precipitation indicates the presence of alkaloids. To the

second portion, 1ml of Mayers reagent was added, an appearance of blue colored precipitation indicates the presence of alkaloids. And to the last portion 1ml of Wagner's reagents was added and a dark- brown precipitation indicates the presence of an alkaloids.

Test for Tannins

0.5g of the extract was dissolved in 10ml of distilled water and filtered blue-green precipitates indicates the presence of tannin.

Test for Carbohydrates

The extract was dissolved in 5ml of distill water and filtered. The filtrate was then treated with 2 drops of alcohol a-naphtha solution in the test tube. The formation of violet ring at the junction indicates the presence of carbohydrates.

Test for Glycosides.

In 5ml plant extract, 2ml of glacial acetic acid, one drop of iron chlorides (FeCl) and concentrated tetraoxosulphate (vi) acid H₂SO₄ was added. The absence of brown ring indicates the absence of glycosides.

Test for Phytosteroland Triterpenoids (Steroids)

The extract was dissolved in water and then treated with Chloroform. The liquid was then be separated using a funnel. The chloroform portion was collected and then divided into two 2 portions to be used for the test to get specific steroid among the group.

Salkowski's Test

A few drops of concentrated sulphuric acid was added to the filterate by the wall of the test tube. The appearance of golden yellow color indicates the presence of triterpenoid.

Libermann Burchard's Test

A few drops of acetic anhydride was added to the filtrate in a test tube, then followed

by the addition of conc. sulphuric acid by the wall of the test tube. The formation of brown ring at the junction indicates the presence of phytosterols.

Experimental Design

A total of twenty (25) Kano brown goats were used in the study. The does were randomly allocated to five treatments and replicated five times. One buck was assigned to each treatment group in a completely randomized designed (CRD).

Determination of fertility Parameters

Fertility parameters such as standing heat and pregnancy were calculated as shown below:

$$\text{Estrus rate} = \frac{\text{Number of goats on standing heat}}{\text{Number of goats synchronized}} \times 100\%$$

$$\text{Pregnancy rate} = \frac{\text{Number of pregnant goats}}{\text{Number of synchronized goats}} \times 100\%$$

Data Analysis

Onset of estrus, estrus response rate and conception rate were analyzed using simple percentage, while correlations of reproductive parameters were carried out using SAS Version 10.

RESULTS

Phytochemistry of *Crossopteryx febrifuga*

The Phytochemical screening of ethanolic extract of *Crossopteryx febrifuga* (stem bark) revealed the Presence of Alkaloids (4.13%), Flavonoids (1.96%), Saponins (1.05%), Tannins (2.11%), Steroids (6.54%), and Phenols (2.34%), while Glycosides and Terpenoids were not determined as presented in (Table 1).

Table 1: Phytochemical Composition of *Crossopteryx febrifuga* (Stembark)

Phytochemicals	Qualitative	Quantitative (%)
Alkaloids	+	4.13
Flavonoids	+	1.96
Saponins	+	1.05
Tannins	+	2.11
Steroids	++	6.54
Phenols	+	2.34
Glycosides	ND	-
Terpenoids	ND	-

++ = High concentration, + = Moderate concentration. ND = Not detected

Onset of estrus, Estrus response rate and Conception rate of does

Animals in group 1 served as control and did not show any sign of estrus. Of the 20 does, three (3) does exhibited heat within 24-48, 6 in 48-72 hours, 4 between 72-96 hours and 2 expressed heat within 96 -120 hours after *Crossopteryx Febrifuga* (Stembark) extract

administration. The estrus response rate and Conception rate were 0, 100, 60, 40 and 100% and 0, 80, 60, 20 and 80% for groups 1,2,3,4 and 5 respectively as shown in Table 2 and figure 1. All does were tested for pregnancy 40 days following extract administration with Barium Chloride using Barium Chloride Urine Test Method

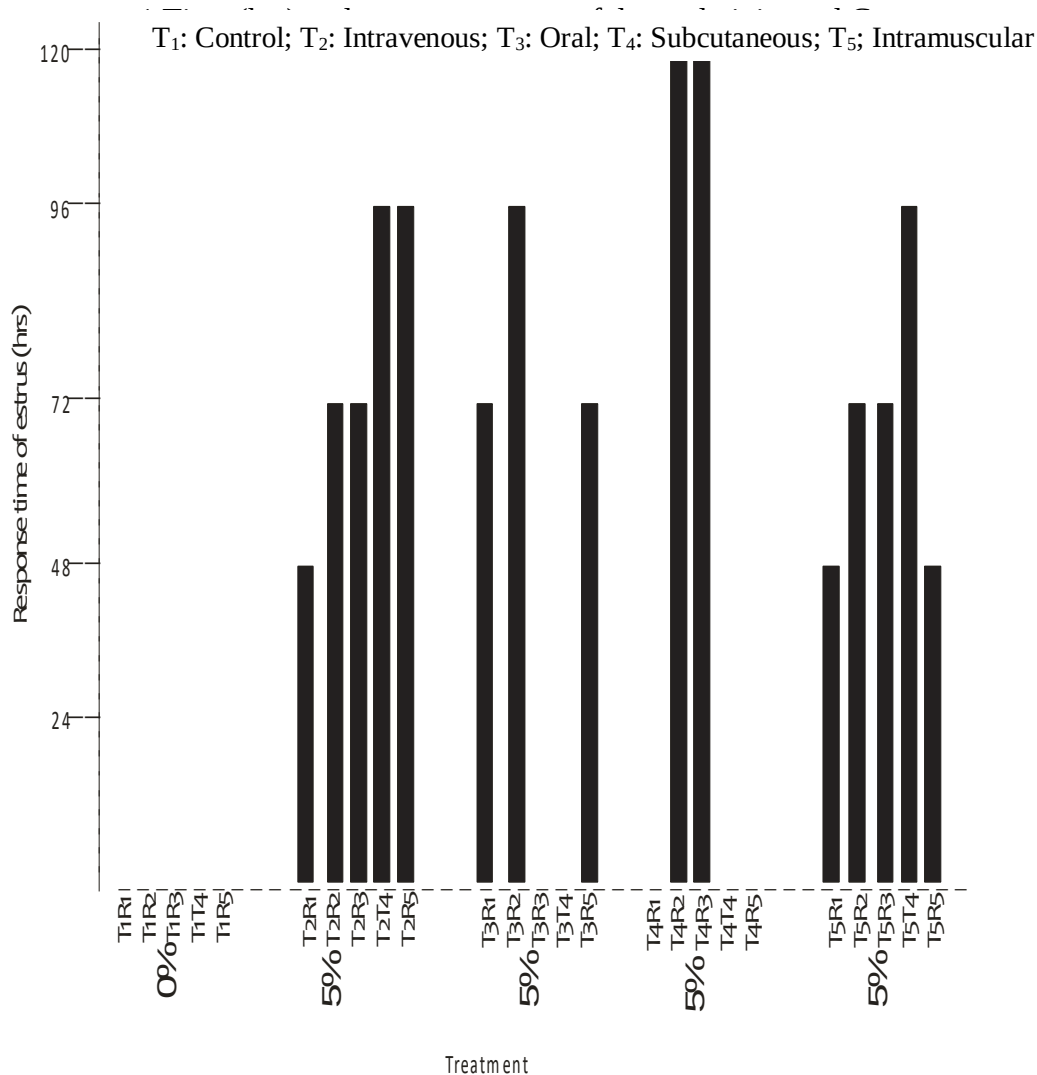


Figure 1: pteryx febrifuga extract at 5% levels of concentration in different routes of administration.

Table 3: Concentration, Route of administration, Onset of Estrus and Conception Rate of Sokoto Goats.

Trt	Conc.	Age	R/A	Response Time of estrus (hours)					Number of Does/Response rate (%)	
(%)	(yrs.)			0-24	24-48	48-72	72-96	96-120	Estrus rate	Conception rate
T1	0%	1-1.5	CRL	0	0	0	0	0	0/5(0)	0/5 (0)
T2	5%	1-1.5	IV	0	1	2	2	0	5/5(100)	4/5 (80)
T3	5%	1-1.5	OR	0	0	2	1	0	3/5(60)	3/5 (60)
T4	5%	1-1.5	SC	0	0	0	0	2	2/5 (40)	1/5 (20)
T5	5%	1-1.5	IM	0	2	2	1	0	5/5(100)	4/5(80)

Key = RA= Routes of administration of the extract. Trt =Treatment

CRL- Control, IV – Intravenous, OR – oral, SC – subcutaneous, IM – Intramuscular

Table 4: Correlation of Different Reproductive Parameters in Kano brown Goats

Variable	Con.	Estrus	Weight	Age	Calc. d.	BCS
Conc	1.00					
Estrus	0.75**	1.00				
Weight	0.07 ^{ns}	-0.07 ^{ns}	1.00			
Age	1.00	1.00	1.00	1.00	1.00	
Calc. d.	0.81**	0.72**	0.09 ^{ns}	1.00	1.00	
BCS	0.14 ^{ns}	0.70**	-0.02 ^{ns}	1.00	0.16 ^{ns}	1.00

Key: Con: Concentration; Calc.d; Calculated doses; BSC: Body Condition Score.

Correlation between reproductive parameters

Significant positive correlations exist between estrus and concentration ($P < 0.01$), calculated doses and concentration ($P < 0.01$),

calculated doses and estrus ($P < 0.01$), body condition score and estrus ($P < 0.01$) as presented in Table 4.

DISCUSSION

The results of phytochemistry obtained in this study were in agreement with (Adebayo *et al.*, 2017; Oyeleke *et al.*, 2008) but, slightly different with (Bobbo *et al.*, 2021). The reason could be certain phytochemicals may be found in only one part of the plant and not in the other. Furthermore solvent play a crucial role in phytochemical analyses or sometimes concentration of plant constituents of the same plant organ can vary from one geographical location to another.

The presence of important phytochemicals, such as: alkaloids, flavonoids and phenols in the stem bark and leaves of *Crossopteryx febrifuga* plant is pertinent as these groups of secondary metabolites are medically beneficial and other phenolic

compounds are potent water-soluble antioxidants and free radical scavengers that prevent oxidative cell damage and have strong anti-cancer properties (Okwu, 2004).

The presence of steroids in this study reveals the activity of the plant in stimulating estrus in animals.

Onset of Estrus

The response time of estrus or onset of estrus in this present study disagreed with Lemaster *et al.* (2001) who reported 48-72hrs after PGF_{2α} injection. Kebede *et al.* (2013) reported 60-72hrs following administration of PGF_{2α}. Bobbo and Gladys (2019) reported 48-96hrs following *Ficus sur* administration in cattle. Variation in the onset of estrus exhibited by the animals may be due to the stage of

follicular development at the time the stem bark extract was administered which affected the interval from administration to standing estrus or the variation was created by differences among ewes in the rate of regression of the corpus luteum following treatment. The duration and the pattern of estrus expression in this study is in consonance with Bobbo and Dauda, (2021) following administration of *ficus sur* leaves in sokoto red goats

Estrus Response Rate

The estrus response rate obtained in intravenous and intramuscular routes of administration in the present study is higher than the 47% (Robinson and Moore, 1967), 90% reported by (Tumen, *et al.*, 1992), 77% reported by (Mansour *et al.*,1993), 80.9% reported by (Abdullah *et al.*,2002), 85% reported by (Lethy *et al.*,2003), 84% reported by (Abdel-Mageed,2006), 62.5% (Patil and Pawshe 2011), 80% or greater (Hussein *et al.*, 1998), but inconsonance with 100% reported in Karakul ewes (Hashemi *et al.*, 2006), 100% reported in Akkaraman Crossbred ewes (Akoz *et al.*, 2006). The estrus response rate also compares favorably with the findings of the Previous studies by Nasroallah *et al.* (2012) who reported 93.3% when used PGF_{2α}- FGA-eCG protocol, 71.4% when used PGF_{2α}- FGA-GnRH protocol. 96%,by (Koyuncu and Alticekic 2010). The combination of GnRH + PGF_{2α} and PGF_{2α} + PGF_{2α} injections had 93.7% and 86.6% estrous rate in sheep during breeding season (Ataman and Akoz, 2006), 8% by Bowdridge *et al.* (2013) in Boer goat. Nur *et al.* (2013) found that Progesterone had 92% and 84% estrus rate.

The Conception Rate

The conception rate in intramuscular and intravenous routes of administration in this study were slightly higher than 72% reported by (Hussein *et al.* 2003), 72% by (Abdel-Mageed 2006), 76.4% (Tumen *et al.*, 1992), 60% and 78% (Riaz *et al.*, 2012) and 53% Bowdridge *et al.*, (2013) in Boer and Crossbred -Boer goats during breeding season. On the contrary the result disagreed with (Akoz *et al.* 2006, Huseyin and Yildiz, 2005, Gulyuz and Kozat 1995) who obtained 100%, 100% and 96% pregnancy rate respectively. The finding of this study is slightly lower than 85.7% and 84.6% pregnancy rate in sheep during breeding season (Ataman and Akoz, 2006). The discrepancy in

the results reported by different researchers on pregnancy and estrus response rate could be explained by the differences in body condition, breed, genotype, housing, management system and stage of follicular development. It has been observed that flushing animals with high energy feed following administration of synchronizing drugs results in very high response rate (Cruz *et al.*, 1991).

The strong positive correlation between body condition score and estrus in this study is in agreement with (Kleeman and Walker 2006) on Merino Ewes. Similarly, significant strong correlation obtained in this work is inconsonance with (Johnson *et al.*, 1974). Furthermore the significant strong positive correlation between estrus and concentration in this study agreed with (Lemon *et al.*, 1975). The non -significant negative correlation ($r = -0.07$) between weight and estrus in this study disagreed with Francisco *et al.*, (2020) who reported no correlation. Also non-significant negative correlation obtained in this study disagreed with Nsoso *et al.*, (2003) reported no correlation between weight and body condition score.

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