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Full Length Research

Approaches for elective induction of kidding in the Sudanese Nubian goats

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ABSTRACT: In the Sudan, the husbandry system of goats in urban and peri-urban areas subject them to kid in streets, under vehicles and in dirty environments thus exposing the newly born kids to the risk of predators, crush under vehicles, exposure to diseases and occasionally death due to the unattended difficult birth. Therefore, need to control time of kidding for survivability of kids and future fertility of the dam was the overall objective of this study. In a randomized block design experiment, twenty mid-term pregnant Nubian goats were assigned to four treatment groups namely, control (1), prostaglandin $F_2\alpha$ ($PGF_2\alpha$) treatment (2), dexamethasone treatment (3) and cesarean operation (4), with an overall aim of selecting an appropriate tool for elective induction of parturition that preserves life and health and future fertility of does as well as production of viable kids. The hormonal treatments and caesarean operation were performed on day 140 of gestation in all the treatments. The shortest induction time was seen with caesarean section (1.25±0.72 hours) and dexamethasone showed the longest time for induction (57.40±9.21 hours) followed by $PGF_2\alpha$ treatment (29.00±1.37 hours). All the treatments resulted to ease of kidding, preserved the reproductive life of does and produced viable kids, except caesarean operation that significantly resulted in delayed placenta expulsion (22.20±2.86 hours) and delayed the time for resumption of ovarian cyclicity (58±5.25 days). In conclusion, the study recommended the use of prostaglandin F2α hormone as a valuable tool for strategic elective induction of kidding in the Sudanese Nubian goats because of its shortest induction time, early placental expulsion and return to ovarian activities.

Keywords: Cesarean section, dexamethasone, induce kidding, Nubian goats, prostaglandin.

INTRODUCTION

Goats population in the world was estimated to be 738.2 million, 218.6 million in Africa and 42.6 million in Sudan (FAO, 2003). In Sudan, Nubian goats constitute 46% of goats' population and are considered to be the best dairy goat in Africa **(**FAO, 2003). The dominant goats' management system in the urban and peri-urban areas of Sudan, goats scavenge for their food in the streets, markets and garbage bins at day time to return home voluntarily at evening for night shelter and protection. Mating, pregnancy and parturition are uncontrolled. Kidding may take place in the markets, streets, near garbage bins, under cars or Lorries thus exposing kids to be crush by vehicles, dogs as predators, environmental hazards such as the extremes of weather, microbial infection especially when a doe kids at or near an unhygienic area.

This management system dictates the need to enhance goat reproductive performance through controlled parturition. Controlled induction of parturition has extra benefit which were elucidated by Braun (1979) in prevention of pregnancy toxemia, ensures the presence of the owner during parturition to offer assistance to primiparous or aged doe, control of infection by removal of new born to clean environment, control of diseases transmitted through consumption of colostrum or milk, like mycoplasmosis that can be controlled by removing the kids at birth and not allowing them to suckle their dams, in addition to diseases that are contracted while searching for

the udder such as caseous lymphadenitis. Other indications for induced parturition would include late term injuries, assisting in potential cases of dystocia by Pygmy breeders and finally the need for reduction of time for supervision of does before kidding.

The events leading to normal parturition in the goat required maturation of the fetal adrenal cortex and surfactant (Noakes et al., 2009). Kidding has been successfully induced using PGF2α hormone and its analogues (Bosu et all., 1979; Ott et al., 1980). The induced labor may result into increased incidence of retained placenta and poor viability of the fetus due to low surfactant production when parturition is induced 10 to 14 days before term. However, the use of prostagandin (PGF2α) alone or its analogues have been the protocol more widely used to induce the parturition in goats (Bretzlaff and Ott, 1983; Romano et al., 2001).

Dexamethasone or exogenous glucocorticoid administered to the mother can be used to induce parturition in the cow, sheep and goat (Thorburn et al., 1972). When administered about a week or less before term, they are generally effective (Bosc et al., 1977). The induction is more precise when estrogens are given within the last four days of term (Currie et al., 1976). However, the use of either corticosteroids or estrogens alone result in some undesirable side effects like increased retained placenta, dystocia, poor milk production and poor fetal survival (Ott et al., 1980).

Most of the cases indicated for caesarian section in goats were due to dystocia and rarely elective ones (Purohit et al., 2006; Noakes et al., 2009; Hussain and Zaid, 2010; Naoman et al., 2013; Anusha et al., 2016). Elective cesarean operation of a pregnant doe can be performed at day 140 of pregnancy and has been recognized as a successful method to enhance neonatal survival. It is a common surgical procedure that can be useful and rewarding to both client and the veterinarian (Ismail, 2017).

Despite the undisputable contributions of goats to socio-economic and cultural welfare of households and the nation, policies to enhance researches that exploit productive and reproductive potentials of goats are lacking, thus reflecting in the scarcity of information in the available literature concerning control of reproductive processes in Sudanese goats. Therefore, this study was conducted to determine the response of Nubian goats to elective hormonal and surgical induction of parturition, doe reproductive health during and post-induction, time for the resumption of ovarian activity post-induction, and to assess fetal viability.

MATERIAL AND METHODS

Study area

This study was conducted in the clinic and experimental animal pens of the Department of Surgery and Reproduction, College of Veterinary Medicine, Sudan University of Science and Technology (SUST) located in Hillat Kuku in Eastern Nile locality of Khartoum State, Sudan. The area represents a typical semi arid zone with substantial variation in temperature and humidity.

Experimental animals

A total of twenty pregnant Nubian goats, aged 2 to 4 years were selected from the local market after confirming their freedom from foreign body. Their gestational periods were diagnosed first by abdominal palpation and then confirmed by ultrasonography to determine kidding dates. The animals were housed in well ventilated pens, subjected to clinical examination before starting the study. They were ear tagged and distributed to experimental groups.

Experimentation

Adaptation period

The animals were kept for an adaptation period of 2 weeks, and given a balanced concentrate ration of 0.5 kg/head/days in their stalls. Mineral salt licks and water were also offered ad-lib. A prophylactic dose of broad spectrum antibiotic (Tyloject 20%) was administered intra-muscularly for five days. They were also treated against ecto- and endo-parasites by using Ivomec super given subcutaneously and repeated after 14 days interval and tested for brucellosis and toxoplasmosis.

Determination of gestational stages

All the 20 does were subjected to ultrasound scanning using B-mode real time scanner (Pie medical Easote, The Netherlands) equipped with switchable frequency (3.5-5 MHz) curvilinear trans-abdominal transducer to determine gestational stages and viability of the fetus. Does of different gestational periods were identified and assigned to the four treatment groups.

Experimental design

The 20 pregnant goats were randomly assigned into the four treatment groups, control group (natural kidding n=5), caesarean operation group(n=5), dexamethasone group (n=5) and $PGF_2\alpha$ group (n=5).

Group 1 (control group): Does in this group were pregnant at different gestations period. They were not subjected to any treatment. They were monitored for normal kidding, duration and time for placenta expulsion.

Group 2 (prostaglandin treated group): In this group, 15 mg of $PGF_2\alpha$ (Cloprostenol, copper LTD, LOT 053080B)

was administered intramuscularly to each doe on day 140 of gestation in the morning hours. They were observed continuously to record the induction time, kidding ease, birth weight and kids and maternal survival, postpartum health, time of foetal membranes expulsion, survival and viability of the kids and resumption of ovarian cyclicity postpartum.

Group 3 (Dexamethasone treated group): In this group, 25 mg dexamethasone (Biodexone-E.G. Pharma, India) was administered intramuscularly to each doe on day 140 of gestation in the morning hours. They were observed continuously to record the induction time, kidding ease, birth weight and kids and maternal survival, postpartum health, time of foetal membranes expulsion, survival and viability of the kids and resumption of ovarian cyclicity postpartum.

Group 4 (cesarean section group): Pregnant does in this group were subjected to cesarean section operation on Day 140 of pregnancy according to according to Kumar et al. (2013) and Fubini and Ducharme (2004). Time in hours spent by the surgeon to operate each doe leading to extraction of foetus after induction of anesthesia was recorded.

Induction time is defined as the interval from the injection time till complete delivery of the first kid (Romano et al., 2001). Fetal membranes were determined as retained if they were no expelled within six (6) hours after the delivery of the last kid. Neonatal mortality is defined as when kids were born dead or died in the first 48 hours after birth. Immediately after induce of parturition kids were weighed and feeding with colostrum within the first 2 hours after birth.

Kids weight gain

After kidding the weight gain of all surviving kids were assessed daily from delivery time till weaning using 50 kgs spring balance (Salter India Limited. An ISO 9001: 2008 Company, Ballabhgarh, 121004, Haryana). This daily practice aimed to determine the viability of the kid as a result of the treatment compared to control.

Post-induction returns to ovarian activity

After two weeks of induction of kidding, does were introduced to a buck for estrus detection which is one of strong signs of return to ovarian activity.

Data analysis

The quantitative data was inserted into Microsoft Excel and analyzed using SPSS package version 19. Means of parameters in each treatment group were compared. Significance level set at $p \leq 0.05$.

RESULTS

Induction time and placenta expulsion

All does in the treatment groups kidded with ease. There was no mortality among does and kids (20/20, 100%) including those subjected to caesarian operation. Kidding rate was 135% (27/20). Significant difference was observed in induction time of kidding with dexamethasone and caesarian section (Table 1). In this study, the Mean±SD of time taken to extract fetus through caesarean operation was between 1to 2 hours. However, induction by dexamethasone was significantly delayed ($p<0.05$) compared to control and prostaglandin groups (Table 1). Longer time was taken for the placental expulsion in cesarean operation group compared to control and prostaglandin groups (Table 1).

Fetal viability

After birth, foetal activity such as standing up, seeking teats and sucking, morbidity, evidence of daily weight gain after birth for 4 weeks, were considered as measures of fetal viability. This study showed that there was no significant difference in their weight after birth (Table 2) and the other measures of kids' viability were not compromised**.** Mean weight ranged between 2.30 to 2.76 kg. After 2 to 4 weeks to weaning, kids in all treatment groups showed progressive increase in their daily weight gain (Table 2). The higher limits recorded among different groups were 3.30, 3.88, 4.30 and 4.56 kg for caesarian section, prostaglandin, control and dexamethasone groups, respectively. Although significant differences were not observed in the daily weight gain of kids in different treatment groups, kids gaining weights daily after kidding is a strong measure of kids' vitality.

Post-induction fertility

In this study, postpartum resumption of ovarian activity in the kidding induced does was indicated by return to estrous cycle expressed by display of signs of estrus which is considered as a true measure of female fertility post-induction. There was an increased incidence of resumption of ovarian cyclicity by day 40 to 42 in control and dexamethasone groups. Does subjected to caesarian operation showed significantly ($p<0.05$) late resumption of ovarian cyclicity (Table 1) when compared to other groups. Does which failed to display estrus signs beyond 60 days in all the treatments (30%, 6/20) were considered as cases of anestrous requiring further infertility investigations.

Table 1. Mean ±SD of induction time, placenta expulsion time and ovarian activity resumption time.

Parameter	Treatment Group				Sig
	Control	PGF2α	Dexamethasone	C.S	
Induction time (hours)	2.0±0.23[a]	29.00±1.37[b]	57.40±9.21[a]	1.25±0.72[a]	**
Placenta Expulsion time (hours)	2.20±0.57[b]	2.30±0.45[b]	2.98±0.63[b]	22.20±2.86[a]	**
Ovarian activity resumption time (days)	42±6.12[b]	46±8.23[b]	40±7.11[b]	58±5.25[a]	**

Superscripts [a,b] indicate significant difference between groups at p<0.05; ** highly significant p<0.01.

Table 2. Mean±SD of new born kids' weight (kg) at different weeks after birth.

Parameter	Treatment Group				Sig
	Control	PGF2α	Dexamethasone	C.S	
Weight after birth	2.76±0.61	2.66±0.23	2.30±0.32	2.50±0.36	NS
Weight after 2 weeks	3.04±1.72	3.07±1.99	3.45±0.86	2.50±1.40	NS
Weight after 4 weeks	4.26±2.40	3.88±2.32	4.56±0.93	3.30±1.85	NS

NS Non-significant p>0.05.

DISCUSSION

The current goats' husbandry system in the Sudan is a major risk factor that contributed significantly to loss of kids during kidding process due to adverse extremes of weather, predators, diseases, dystocia and physical incidences. The technique of elective induction of kidding is lightly known and perceived by goats' owners. It is considered as an appropriate intervention tool to ameliorate these problems, enhance parturition and improve production and productivity of goats in the Sudan.

The results in this study are relevant to some of the circumstances and where planned compact kidding is required to improve the efficiency of skilled labor resources. The expected overall out puts in the use of these procedures are preservation of life and health of the dam and kids, the subsequent reproductive performance of does by return to ovarian cyclicity.

The study resulted in to kidding of 27 viable kids from 20 does with kidding rate of 135%. Kids from all the treatment groups showed similar progress in daily weight gain. No mortality occurred among kids and the dams, kidding were without cases of dystocia. Dexamethasone group experienced delayed in induction time of kidding compared to other groups (p<0.05). Braun (2007) reported dexamethasone (20 mg) induced kidding within 94 to 147 hours. The discrepancy may be due to differences in the management system that might have interfered with one of steps in hormonal expressions. There was no difference in the viability of the kids or in the incidence of retained placentas. However, similar induction time was reported by Ott et al. (1980), but with retained foetal membranes.

Depending on the experience of the operating surgeon for caesarean section, the shortest induction time (1 to 2 hours) was observed in this group, but it was followed by significant delay in placenta expulsion, and delay in resumption of ovarian cyclicity when compared to control and other treatment groups. This result agreed with reports of Sharma et al. (2014) and Leontides et al. (2000) in that the most common complication following surgery was retained placenta and this may be the consequence leading to delay resumption of ovarian cyclicity and post-induction fertility. The current study however agreed with the report of Blount et al. (2004) that the prognosis of caesarian section in sheep and goats is good when minimum vaginal manipulation was performed before prompt referral for surgical intervention.

In the current study, $PGF_2\alpha$ injection induced kidding within 29.00±11.37 hours. This compared favorably with the report of Batista et al. (2011) in which induction occurred within 30 to 34 hours without any effect on foetal viability or the incidence of retained placenta. Placenta was expelled in the first 6 hours after the induced natural parturition. The result also agreed with that of Romano et al. (2001) who induced kidding within 31 hours and 33 hours using different doses of prostaglandin $F_2\alpha$ and all kids were born alive, no dystocia and retained fetal membranes observed.

This study revealed increased incidence of ovarian cyclicity by day 40 to 42 with the proportion of does displaying sign of estrus ranged between 60% (3/5) to 80% (4/5). Significant delay (p≤0.05) in resumption of ovarian cyclicity was observed in caesarean section group and prostaglandin treated group. This concurred with the study of Šavc et al. (2016), who attributed the delay because prostaglandin $F_2\alpha$ had an additive suppressive effect on the immune system by inducing deregulation of normal uterine PGE/PGF ratio that lower uterine involution in beef cattle. In the same way, delayed placenta expulsion due to cesarean section leads to delayed uterine involution and thus delayed ovarian rebound (Noakes et al., 2009;

Brounts et al., 2004). The present study however concurred with Ismail (2017) statement that little information is available in literature concerning post-operative complications, outcomes and future fertility in small ruminants after dystocia.

Conclusion and recommendation

In conclusion, the use of elective induction of kidding is an effective strategy to advance parturition and did not have a negative effect on kidding progress, dam and kid health. Induction was delayed with the use of dexamethasone compared to $PGF_{2\alpha}$ injection. Although the surgical method was fast in induction, it resulted in delayed placenta delivery and resumption of ovarian cyclicity, thus extension of kidding interval. Therefore, the study recommended the use of prostaglandin $F_{2\alpha}$ as a valuable strategy for elective induction of kidding in Sudanese goats.

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CONFLICT OF INTEREST

The authors declared that they have no conflict of interest as regards to the publication of this research work.

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