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Prevalence of Gynecological Disorders of Goat and Pattern of Drug used at Chuadanga, Bangladesh

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ABSTRACT

Background: Gynecological disorders are the major challenge for Goat production profitability in Chuadanga, a goat dominating district of Bangladesh. To control the gynecological cases of goats in Chuadanga district, it is of utmost importance to estimate the prevalence of them along with their current therapeutic management.

Methods: A cross sectional study was conducted from May, 2018 to April, 2019 on a total of 89 gynecological cases of goat to estimate the prevalence of different gynecological disorders along with drug prescribing patterns at Chuadanga Sadar Upazilla, Chuadanga, Bangladesh. Relevant data on different gynecological cases of goat were collected from the registered sheets of Upazilla Veterinary Hospital (UVH) and used for this study.

Result: The highest prevalence of gynecological case was of anoestrous (20.2%) followed by abortion (18.0%), retained placenta (16.9%), pyometra (10.1%), dystocia (9.0%), repeat breeding (6.7%) and prolapse of the vagina (5.6%). The prevalence of metritis was 4.5% followed by milk fever (4.5%), prolapse of the rectum (3.4%) and postpartum bleeding (1.1%). Prostaglandin (25.0%) followed by a combination of oxytocin and calcium (18.8%) and combination of oxytetracycline and metronidazole (18.8%) were commonly prescribed drugs for treating abortion cases. Vitamin AD_3E (33.3%) was prescribed the highest for treating anoestrous. A combination of oxytocin and oxytetracycline (33.3%), followed by oxytocin (26.6%) were predominantly prescribed for treating retained placenta. This study reveals the overall burden of reproductive disorders of goat along with drug prescribing patterns at the Chuadanga, Bangladesh. This outcome will be supportive to know the better treatment strategy against reproductive disorders in goat.

Key words: Goat, Prevalence, Reproductive disorders, Treatment.

INTRODUCTION

The goat is called the “Poor man’s cow”, the second important livestock species in Bangladesh, which have a significant contribution in the pastoral economy and earns a substantial amount of foreign currency by exporting skin and other by-products (Ali *et al.*, 2013; Ahmed *et al.*, 2019). About 25.7 million goat heads are distributed in Bangladesh (Kumar *et al.*, 2018). However, reproductive disorders affect goat production profitability by decreasing milk yield and increasing the culling rate (Talukder *et al.*, 2005). Besides, infertility is a particular problem in goat rearing because of requiring more services per conception and higher incidence of gynecological problems (Purohit, 2006). Overall, 10-30% cases, the lactation is affected by infertility and other reproductive disorders and annually a range of 3-6% herds are discarded in developed countries for gynecological reasons (Humblot, 2001). Gynecological disorders are responsible to slow down the uterine involution and reduction of conception rate which ultimately increases the medication cost and drop off the overall milk production resulting a considerable economic loss of the farmers (Khair *et al.*, 2014). Chuadanga, a district city of Bangladesh, where goat is the common livestock but there is a lack of constructive study on reproductive disease status of goats at this area (Talukder *et al.*, 2005; Parvez *et al.*, 2014). Hence, this area has been selected for the study.

Therapeutic management is the most commonly practiced way to deal with the gynecological cases in goats (Bhattacharyya *et al.*, 2015). Many authors from different countries have reported on the drug-use pattern against reproductive disorders which is scarce in Bangladesh (Smith and Sherman, 2009; Abecia *et al.*, 2011). A wide range of antibiotics has been suggested by LeiteBrowning (2006) for bacterial abortion where prostaglandin (PGF2α), estrogen, and oxytocin or a combination of calcium and oxytocin have been used to manage retained fetal membranes. Considering these facts, the present study was conducted to estimate the prevalence of different gynecological

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disorders in goats and to describe the patterns of drugs prescribed against them at the Upazilla Veterinary Hospital (UVH) of Chuadanga Upazilla, a south-western district of Bangladesh.

MATERIALS AND METHODS

Study site and veterinary service

Chuadanga district of Bangladesh having a 289.59 square km of plain land area is located in between 23°29′ to 23°42′ N and 88°47′ to 89°00′E (Anonymous, 2010). The government of Bangladesh has established a Veterinary hospital at almost every Upazila (sub-district) to provide animal healthcare facility which is operated by Upazila Livestock Officer (ULO), Veterinary Surgeon (VS) and para-vets as supporting staffs (Samad *et al.*, 2020).

A cross-sectional study was undertaken on different gynecological cases of goat recorded at UVH of Chuadanga Sadar during May, 2018 to April, 2019. Data on different gynecological cases of goat were separated from the stock of manually recorded registered sheets of UVH and used for this study.

Data organization

Relevant information from the data sheet was collected and collated in Microsoft Excel spreadsheet-2007 on the headings of - case registration number, date, owner's name and address, owners complain, animal's age, breed, rearing system, types of gynecological cases and drugs that were prescribed.

The data were sorted, cleaned and coded as necessary before transferring to STATA IC-13 (Stata Corp, 4905, Lakeway Drive, College Station, Texas 77845, USA) for statistical analysis.

Goats were divided into four categories according to weight and age separately, based on percentile. Body condition score was defined according to the criteria set by Villaquiran *et al.* (2004) for goat, where BCS-1, 2, 3, 4 and 5 were expressed as Cachectic, Poor, Fair, Good and Excellent category, respectively. Season was defined as summer (March-June), rainy (July-October) and winter (November-February) as described by Sayeed *et al.* (2020).

Statistical analysis

Descriptive analysis was performed on different gynecological disorders along with different factors and drugs prescribed pattern. The estimated output has been expressed as frequency number and percentage.

RESULTS AND DISCUSSION

Prevalence of different gynecological disorders of goats: Eighty-nine gynecological cases were recorded during the study and the prevalence of different gynecological disorders has been presented in Table 1. The calculated prevalence of anoestrus (20.2%) was lower than the reported prevalence of 31.25% by Lucky *et al.* (2016) in Bangladesh. This disagreement might be due to the differences in study area.

Table 1: Frequency distribution of different gynecological disorders in goats recorded at the UVH.

Name of Cases	n	%
Anoestrous	18	20.2
Abortion	16	18.0
Retained placenta	15	16.9
Pyometra	9	10.1
Dystocia	8	9.0
Repeat breeding	6	6.7
Prolapse of the vagina	5	5.6
Metritis	4	4.5
Milk fever	4	4.5
Prolapse of the rectum	3	3.4
Postpartum bleeding	1	1.1

The estimated prevalence of abortion was 18.0% in this study which was higher than 12.5%, revealed in goat population by Lucky *et al.* (2016) in Bangladesh. Besides, the prevalence of retained placenta was 16.9% which is much higher than that of 1.02% and 6.25% prevalence observed by Alam *et al.* (2015) and Lucky *et al.* (2016) respectively, in different districts of Bangladesh. Again, the prevalence of pyometra was 9.0% which is in line with the previously estimated prevalence (9.37%) in goats by Lucky *et al.* (2016). The discrepancies between the study findings and previously estimated prevalence is due to difference in breed in different study area (Alam *et al.*, 2015).

Factor specific prevalence of major gynecological cases in goats

The findings on season, rearing system, breed, age, BCS and weight assessed with abortion, anoestrous and retained placenta to know the factor specific prevalence are presented in Table 2.

In this study, the prevalence of abortion was higher during winter supported by Ali *et al.* (2013) where earlier study reported a higher prevalence of abortion during rainy season (Islam *et al.*, 2015). Retained placenta cases were higher during summer in correspond to other season which is in line with previous studies (Faruque *et al.*, 2010). However, this finding is differed with Islam *et al.* (2015) who reported higher prevalence of retained placenta during rainy season. Again, the prevalence of anoestrus was higher during winter followed by summer and rainy season supported by Islam *et al.* (2015). In Bangladesh goat feeding is largely affected by grazing. Winter season affects pasture grazing, produce nutritional inadequacy that might be contributed to development of anoestrous (Dutt *et al.*, 2011).

A higher prevalence of abortion was calculated in semi-intensive than tethering system which is in accordance with (Engeland *et al.*, 1998). Again, anoestrus and retained placenta was also higher in the semi-intensive system than tethering which may be due to the difficulties to maintain a good health status and prevention of unusual mating in semi-intensive system.

The crossbred goat was more likely to abort than others,

Table 2 Frequency distribution of major gynecological disorders in goats according to different variables at the UVH.

Variable	Class	Abortion, n (%)	Anoestrous, n (%)	Retained placenta, n (%)	*p-value*
Season	Summer	6 (37.4)	6 (33.3)	8 (53.3)	0.8
	Rainy	3 (18.8)	5 (27.8)	3 (20)	
	Winter	7 (43.8)	7 (38.9)	4 (26.7)	
Rearing system	Semi-Intensive	12 (75.0)	14 (77.8)	10 (66.7)	0.6
	Tethering	4 (25.0)	4 (22.2)	5 (33.3)	
Breed	Non-descriptive	10 (62.5)	7 (38.9)	4 (26.7)	0.3
	Black Bengal	5 (31.3)	6 (33.3)	7 (46.7)	
	Jamnapari	1 (6.2)	5 (27.8)	4 (26.6)	
Age (mo)	9-15	3 (18.8)	6 (33.3)	4 (26.7)	0.6
	16-18	6 (37.5)	2 (11.1)	6 (40.0)	
	19-24	4 (25.0)	6 (33.3)	3 (20.0)	
	25-27	3 (18.7)	4 (22.3)	2 (13.3)	
Body condition score	Cachectic	1 (6.3)	1 (5.6)	1 (6.7)	0.9
	Poor	5 (31.3)	4 (22.2)	2 (13.3)	
	Fair	6 (37.4)	7 (38.9)	8 (53.3)	
	Good	4 (25.0)	6 (33.3)	4 (26.7)	
Body weight (kg)	15-20	6 (37.4)	4 (22.2)	9 (60)	0.3
	21-24	3 (18.7)	2 (11.1)	2 (13.3)	
	25-27	3 (18.7)	6 (33.3)	1 (6.7)	
	28-35	4 (25.0)	6 (33.3)	3 (20.0)	

which differed with Unanian and Silva (1989) who reported higher abortion rates in exotic breeds than in native breeds. Again, anoestrous was higher in crossbreds, which may be due to poor breeding management at the farm level of Bangladesh agreed with Alejandrino *et al.* (1999). However, higher prevalence of retain placenta estimated at Black Bengal goat might be due to increased litter size (Hassan *et al.*, 2007).

For age category, retained placenta and abortion cases were proportionately higher among young (16-18 months old) does than older ones which is supported by Mellado *et al.* (2004) and Ali *et al.* (2013). However, anoestrous was higher in 9-15 months of aged does which is agreed with Islam *et al.* (2015).

Among BCS category, the animals with a fair BCS were more prone to gynecological disorders including abortion, retained placenta and anoestrous which can be metaphorized with the findings of Mellado *et al.* (2004) who reported the change of abortion rate with the change of one unit of BCS. Moreover, the abortion and retained placenta was higher among the goat with lower body weight which might be due to poor feeding and nutrition of the animals supported by Lucky *et al.* (2016).

Drugs prescribed for different gynecological disorders of goats at the UVH

Gynecological cases were treated using single drug therapy or combined drug therapy. In abortion, prostaglandin (25.0%) was prescribed most commonly. A combination of oxytocin with calcium (18.8%), a combination of oxytetracycline with metronidazole (18.8%) and a combination of oxytocin with metronidazole (12.5%) were also prescribed to treat abortion. Gonadotrophin releasing hormone (22.2%), vitamin AD_3E (33.3%), combined preparation of amino acid, selenium and vitamin E (22.2%) were more frequently prescribed for managing anoestrous. A combination of oxytocin and oxytetracycline (33.3%), followed by a combination of prostaglandin, streptomycin, penicillin and oxytetracycline (20.0%) were predominantly prescribed for treating retained placenta (Table 3).

In abortion cases, prostaglandin, a combination of oxytocin and calcium, oxytetracycline and metronidazole, and oxytocin with metronidazole were commonly prescribed. To remove the fetal membrane with other contents, oxytocin has been suggested to administer, whereas calcium was suggested to increases the tonicity of the smooth muscle of the uterus (Hammond, 2009). Oxytocin with antibiotic was commonly used in the treatment of retained placenta (Cohen *et al.*, 1995).

Vitamin AD_3E, combined GnRH with Vitamin AD_3E, amino acid, selenium and vitamin E were more frequently prescribed for managing anoestrous because selenium, zinc, vitamin A and E are essential sources for health and reproductive performance of small ruminants (Blache *et al.*, 2008).

Among other reproductive disorders of goats, vaginal prolapse was treated with intravenous and oral administration of calcium. The administration of oxytocin along with calcium solution was practiced for management of dystocia which is in line with the earlier study conducted by Brounts *et al.* (2004). In milk fever, the amino acid was prescribed along with calcium which is supported by Oetzel and Goff (1998).

Metronidazole was used in pyometra to treat protozoal

Table 3: Frequency distribution of drugs prescribed for gynecological disorders of goats at the UVH.

Drug	Abortion n (%)	Anoestrous n (%)	Retained placenta n (%)	Postpartum bleeding n (%)	Rectal prolapse n (%)	Metritis n (%)	Milk fever n (%)	Vaginal prolapse n (%)	Repeat breeding n (%)	Dystocia n (%)	Pyometra n (%)
GnRH	-	4 (22.2)	-	-	-	-	-	-	1 (16.6)	-	-
Oxytocin	-	-	4 (26.6)	-	1 (33.3)	-	1 (25.0)	5 (100)	-	-	-
Vitamin AD_3E	-	6 (33.3)	-	-	-	-	-	-	2 (33.3)	-	-
Prostaglandin	4 (25.0)	-	-	-	-	-	-	-	1 (16.6)	-	2 (22.2)
Oxytocin and Calcium	3 (18.8)	-	3 (20.0)	-	-	-	-	-	-	3 (37.5)	-
Prostaglandin and Calcium	1 (6.3)	-	-	-	-	-	1 (75.0)	-	-	-	-
Streptomycin and Penicillin	1 (6.3)	-	-	-	-	-	-	-	1 (16.6)	1 (12.5)	-
Oxytocin and Oxytetracycline	-	-	5 (33.3)	1 (100)	-	-	-	-	-	1 (12.5)	-
Oxytocin and Metronidazole	2 (12.5)	-	-	-	-	1 (25.0)	-	-	-	2 (25.0)	4 (44.4)
Vitamin AD_3E and Amino acid	-	1 (5.5)	-	-	-	-	-	-	1 (16.6)	-	-
Prostaglandin and Oxytetracycline	1 (6.3)	-	-	-	-	1 (25.0)	-	-	-	-	1 (11.1)
Oxytetracycline and Metronidazole	3 (18.8)	-	-	-	2 (66.6)	1 (25.0)	-	-	-	1 (12.5)	-
Prostaglandin, Streptomycin, Penicillin and Oxytetracycline	-	-	3 (20.0)	-	-	-	-	-	-	-	1 (11.1)
Prostaglandin, Streptomycin, Penicillin and Metronidazole	1 (6.3)	-	-	-	-	1 (25.0)	-	-	-	-	1 (11.1)
Amino acid, Se and Vitamin E	-	4 (22.2)	-	-	-	-	-	-	-	-	-
Vitamin AD_3E, Se and Vitamin E	-	3 (16.6)	-	-	-	-	-	-	-	-	-

infection and oxytocin was also used to remove the pus contents from the uterus which is different than the treatment option reported by El-Tahawy and Fahmy (2011), where $PGF_2\alpha$ and oxytetracycline was used to treat pyometra, this difference is due to species variation in the study. Again, a combination of penicillin and streptomycin or oxytetracycline and metronidazole were also used in metritis of goats where long acting oxytetracycline has been suggested by (Majeed, 1994).

CONCLUSION

The study estimated the prevalence of major gynecological disorders including anoestrous, abortion, retained placenta, pyometra and dystocia along with most commonly prescribed drugs against different gynecological disorders used in goats of Chuadanga district of Bangladesh. The knowledge derived from this study can be used in educational and research purposes, finding the future research area and developing treatment protocols for gynecological disorders in goats. The authors suggest to conduct further study for the identification and characterization of etiological factors of various gynecological disorders in goats.

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REFERENCES

Abecia, J.A., Forcada, F., González-Bulnes, A. (2011). Pharmaceutical control of reproduction in sheep and goats. Veterinary Clinics: Food Animal Practice. 27: 67-79.

Ahmed, S.J., Hasan, M., Islam, M.R., Shawan, K., Ali, M.M., Uddin, M., Rahman, M., Hossain, M. (2019). Incidence and Antibiotic Susceptibility Profile of Pasteurella maltocida Isolates Isolated from Goats in Savar Area of Bangladesh. Agricultural Science Digest. 39

Alam, M.A., Amin, M.R., Paul, T.K., Saha, T.K., Rahman, M.K., Rizon, M.K. (2015). Prevalence of clinical diseases and disorders of goats at Upazila Livestock Development Center, Kapasia, Gazipur. Asian Journal of Medical and Biological Research. 1: 47-52

Alejandrino, A., Asaad, C., Malabayabas, B., De Vera, A., Herrera, M., Deocaris, C., Ignacio, L., Palo, L. (1999). Constraints on dairy cattle productivity at the smallholder level in the Philippines. Preventive Veterinary Medicine. 38: 167-178.

Ali, M., Bhuiyan, M., Alam, M. (2013). Retrospective epidemiologic study of diseases in ruminants in Khagrachari hill tract district of Bangladesh. Bangladesh Journal of Veterinary Medicine. 9: 145-153.

Anonymous (2010). Chuadanga District, available at https://en. wikipedia. org/wiki/Chuadanga_District, acessed on February 19, 2020. Wikipedia.

Bhattacharyya, H.K., Bhat, F.A., Buchoo, B.A. (2015). Prevalence of dystocia in sheep and goats: a study of 70 cases (2004-2011). Journal of Advanced Veterinary Research. 5: 14-20

Blache, D., Maloney, S.K., Revell, D.K. (2008). Use and limitations of alternative feed resources to sustain and improve reproductive performance in sheep and goats. Animal Feed Science and Technology. 147: 140-157

Brounts, S.H., Hawkins, J.F., Baird, A., Glickman, L.T. (2004). Outcome and subsequent fertility of sheep and goats undergoing cesarean section because of dystocia: 110 cases (1981–2001). Journal of the American Veterinary Medical Association. 224: 275-281

Cohen, R., Bernstein, M., Ziv, G. (1995). Isolation and antimicrobial susceptibility of Actinomyces pyogenes recovered from the uterus of dairy cows with retained fetal membranes and post parturient endometritis. Theriogenology. 43: 1389-1397.

Dutt, R., Mehrotra, S., Shanker, U., Singh, G., (2011). Effect of Murraya koenigii and Aegle marmelos feeding on anoestrus buffaloes. The Indian Journal of Animal Reproduction. 32: 47-49

El-Tahawy, A.E.-G.S., Fahmy, M.M. (2011). Partial budgeting assessment of the treatment of pyometra, follicular cysts and ovarian inactivity causing postpartum anoestrus in dairy cattle. Research in Veterinary Science. 90: 44-50.

Engeland, I.V., Waldeland, H., Andresen, Ø., Løken, T., Björkman, C., Bjerkås, I. (1998). Foetal loss in dairy goats: an epidemiological study in 22 herds. Small Ruminant Research. 30: 37-48.

Faruque, S., Chowdhury, S., Siddiquee, N., Afroz, M., (2010). Performance and genetic parameters of economically important traits of Black Bengal goat. Journal of the Bangladesh Agricultural University. 8: 67-78.

Hammond, C. (2009). Recent advances in second-trimester abortion: an evidence-based review. American Journal of Obstetrics and Gynecology. 200: 347-356.

Hassan, M.M., Mahmud, S.N., Islam, S.A., Miazi, O.F. (2007). A comparative study on reproductive performance and productivity of the Black Bengal and Crossbred goat at Atrai, Bangladesh. University Journal of Zoology, Rajshahi University. 26: 55-57

Humblot, P. (2001). Use of pregnancy specific proteins and progesterone assays to monitor pregnancy and determine the timing, frequencies and sources of embryonic mortality in ruminants. Theriogenology. 56: 1417-1433.

Islam, M.H., Sarder, M.J.U., Rahman, M.S., Haque, M.A., Islam, M.A., Jahan, S.S., Khaton, R., (2015). Retrospective study of reproductive diseases of small ruminants in northern barind tract in Bangladesh. Sciences. 3: 136-140

Khair, A., Alam, M., Rahman, A., Islam, M., Azim, A., Chowdhury, E. (2014). Incidence of reproductive and production diseases of cross-bred dairy cattle in Bangladesh. Bangladesh Journal of Veterinary Medicine. 11: 31-36.

Kumar, A., Chae, B., Bhuiyan, A., Sarker, S., Hossain, M., (2018). Goat production system at Mymensingh district in Bangladesh. Bangladesh Journal of Animal Science. 47: 13-20.

LeiteBrowning, M. (2006). Causes of infectious abortions in goats. Alab Coop Extension System Publication UNP79.

Lucky, N.S., Hossain, M.K., Roy, A.C., Haque, M.M., Uddin, A.M., Islam, M.M., Howlader, M.M.R. (2016). A longitudinal

study on clinical diseases and disorders of cattle and goats in Sylhet, Bangladesh. Journal of Advanced Veterinary and Animal Research. 3: 24-37.

Majeed, A. (1994). Obstetrical problems and their management in Iraqi goats. Small Ruminant Research. 14: 73-78.

Mellado, M., Valdez, R., Lara, L., Garcıa, J. (2004). Risk factors involved in conception, abortion, and kidding rates of goats under extensive conditions. Small Ruminant Research. 55: 191-198.

Oetzel, G., Goff, J. (1998). Milk fever (parturient paresis) in cows, ewes and doe goats. In: Current Veterinary Therapy 4: Food Animal Practice. WB Saunders Co Philadelphia.

Purohit, G. (2006). Dystocia in the sheep and goat–A review. Indian Journal of Small Ruminants. 12: 1-12.

Samad, M., Haldar, P., Dash, A., Sultana, S., Arfin, S., Bari, M., Sayeed, M. (2020). Cross-sectional survey on food animal diseases and pharmaceuticals prescribing pattern in Jhenaidah, Bangladesh. Research Journal for Veterinary Practitioners. 8: 4-10

Sayeed, M., Islam, B., Nahar, N., Bari, M., Sultana, S., Arfin, S., Haldar, P., Islam, A. (2020). Epidemiology of livestock and poultry diseases in Jhenaidah district of Bangladesh. Advances in Animal and Veterinary Sciences. 8(8): 804-812.

Smith, M.C., Sherman, D.M. (2009). Goat medicine. John Wiley & Sons, Hoboken, New Jersey.

Talukder, M., Khandoker, M., Rahman, M., Islam, M., Khan, M. (2005). Reproductive problems of cow at Bangladesh Agricultural University Dairy Farm and possible remedies. Pakistan Journal of Biological Sciences. 8: 1561-1567.

Unanian, M.M., Silva, A.E.D.F. (1989). Estudos associando a subnutrição ao aborto caprino, na região Nordeste do Brasil. Pesquisa Agropecuária Brasileira. 24: 1221-1228.

Villaquiran, M., Gipson, T., Merkel, R., Goetsch, A., Sahlu, T. (2004). Body condition scores in goats. American Institute for Goat Research, Langston University, available at https://wwwresearchgatenet/profile/Terry_Gipson/blication264889567_Body_Condition_Scores_in_Goats/links/5429 5b190cf238c6ea7d71abpdf, accessed on April 04, 2020.