RESEARCH ARTICLE

Study of Important Blood Metabolites of Surti Goats under Different Estrus Synchronization Protocols

Amol B. Yede[1]*, Chandubhai T. Khasatiya[2], Virendra Kumar Singh[3], Arvind S. Londhe[4], Atul Urkude[5]

Abstract

Reproduction is the key to livestock production especially in goats that have high reproduction potential. Estrus synchronization is useful for rhythmic coordinated variation in reproductive hormones along with level of serum metabolites. Present study was conducted to evaluate variations of important blood biochemical metabolites in Surti goats under different estrus synchronization protocols. 18 Surti goats were divided equally (n=6) in 3 groups, *viz.,* G1, G2 and G3 (control). G1 and G2 groups were injected i/m with GnRH analogue, Buserelin acetate 4.2 µg, on day 0 and 11 and $PGF_2\alpha$ analogue, Dinoprost tromethamine 10 mg, on day 9. Progestogen sponge was also kept intravaginal in G1 group on day 0 and removed on day 11 before Buserelin injection. G3 group acted as control and received placebo of 2 ml normal saline simultaneous to treatment groups. Blood was collected on day 0, 5th, 11th, on the day of estrus and on day 30th post-estrus/mating for analysis of serum glucose, total protein and cholesterol. Levels of glucose, total protein and cholesterol varied non-significantly between groups, but within the group total cholesterol levels increased significantly ($p < 0.01$) at 11th day of treatment and on the day of estrus with a drop on day 30th post-estrus, highlighting its role in estrus and pregnancy. On the day of estrus, coefficient of variation was minimum for cholesterol in both G1 and G2. Thus, it was concluded that synchronization protocols of GPG with intravaginal progestagen and GPG alone did not significantly alter serum glucose, total protein and cholesterol but effectively minimized variation of total cholesterol on the day of estrus.

Keywords: Estrus synchronization, Goat, Ovsynch (GPG), Intravaginal progestagen, Serum metabolites.

Ind J Vet Sci and Biotech (2020): 10.21887/ijvsbt.16.(2,3,&4).16

Introduction

Livestock production invariably depends on reproduction. In species like goat reproduction potential is very high even in unfavorable conditions, however it mostly remains untapped. Limitation to reproductive performance is either due to occurrence of estrus and kidding at different times or high kidding interval. This can be overcome by effective estrus synchronization protocols that can minimize variations of hormones and cause surge of critical hormones in a synchronized manner. Synchronization also permits to schedule kidding to take advantage of feed and reproductive efficiency in goats (Kharche *et al*. 2002 and Goel *et al*. 2003). Efficacy of such protocols may be limited either due to poor nutrition or variation in metabolites that are associated with reproductive hormones. Serum glucose , protein and cholesterol levels are of prime importance during synchronization of estrus for assessing optimal nutritional status. Therefore, present study was undertaken to know rhythmic variations of important blood biochemical metabolites in Surti goats under different estrus synchronization protocols.

Materials and Methods

Present study was conducted in July, 2019. Eighteen adult Surti goats were selected from AICRP unit of LRS, NAU, Navsari (Gujarat). Routine housing conditions and management practices followed at farm for goats as well as bucks used for estrus detection and breeding were as specified by BIS. Goats were divided into 3 groups, *i.e.,* G1, G2 and G3 with 6 goats in each group and synchronized for estrus as per protocol mentioned in Table 1. Estrus detection was performed by parading sexually active buck for 30 minutes twice a day

[1,2]Department of Veterinary Gynaecology and Obstetrics, College of Veterinary Science & AH, Navsari Agricultural University, Navsari-396 450, Gujarat, India

[3]Department of Veterinary Physiology and Biochemistry, College of Veterinary Science & AH, Navsari Agricultural University, Navsari-396 450, Gujarat, India

[4]Department of Animal Nutrition, College of Veterinary Science & AH, Navsari Agricultural University, Navsari-396 450, Gujarat, India

[5]Department of Veterinary Pathology, College of Veterinary Science & AH, Navsari Agricultural University, Navsari-396 450, Gujarat, India

Corresponding Author: Amol B. Yede, Department of Veterinary Gynaecology and Obstetrics, College of Veterinary Science & AH, Navsari Agricultural University, Navsari-396 450, Gujarat, India, e-mail: dr.amolyedevet@gmail.com

How to cite this article: Yede, A.B., Khasatiya, C.T., Singh, V.K., Londhe, A.S., Atul Urkude (2020). Study of Important Blood Metabolites of Surti Goats under Different Estrus Synchronization Protocols. Ind J Vet Sci and Biotech, 16(2,3,&4): 72-75.

Source of support: Nil

Conflict of interest: None.

Submitted: 23/07/2020 **Accepted:** 21/11/2020 **Published:** 25/12/2020

(morning and evening) after 11 days of treatment and visually monitoring behavioral signs of estrus. The animals were bred by natural service after being observed in estrus by selecting bucks as per usual farm practice.

Approximately 1.5 ml whole blood from jugular vein was collected on day 0, 5th, 11th, on the day of estrus and on day 30th post-estrus/mating in vacutainers without anticoagulant. Blood was allowed to clot at room temperature and serum was harvested after centrifugation for 10 min at 2000 rpm and stored at -20°C until further analysis. Estimation of serum glucose was done by GOD-POD method, total protein by Biuret method and total cholesterol by enzymatic endpoint method using assay kits from Randox Laboratories India Pvt Ltd on Merck Microlab 300 Biochemistry analyzer. The data was subjected to analysis of variance and the means were tested for significance by Duncan's multiple range test at 5% and 1%. Results were presented as Mean ± SE.

Results and Discussion

The mean (± SEM) values of serum metabolites for different groups at different reproductive stages in Surti goats are presented in Tables 2 to 4.

Table 1: Estrus synchronization protocol used for Surti goats

	Treatment		
Group	*Day 0*	*Day 9th*	*Day 11th*
G1 (MAP Sponge with GPG)	i/m inj. of GnRH analogue 4.2 µg + intra-vaginal progestogen sponge	inj. of natural $PGF_2\alpha$ 10 mg	inj. of GnRH 4.2 µg after removal of progestogen sponge
G2 (GPG alone)	Same as above without intra-vaginal progestogen sponge	Same as above	Same as above
G3 (Control)	i/m inj. 2 ml NSS (placebo)	i/m inj. 2 ml NSS (placebo)	i/m inj. 2 ml NSS (placebo)

GnRH analogue-Buserelin acetate (4.2 µg 1 ml, Receptal®)
Intra-vaginal progestogen sponge - 60 mg Medroxyprogesterone acetate (MAP)
Natural $PGF_2\alpha$ analogue Dinoprost Tromethamine (10 mg, 2 ml, Lutalyse®)

Table 2: Serum Glucose level (mg/dl) at different time intervals/days in treatment and control groups of Surti does (Mean ± SEM)

	Groups/Treatments (n=6)				
Days of Treatments/ Breeding	*G1 Sponge with GPG*	*G2 GPG alone*	*G3 Control*	*F value*	*P value*
0 day (before treatment)	$49.08 \pm 2.46^{a}w$	$49.18 \pm 2.17_{a}^{xw}$	$50.82 \pm 1.96_{a}^{w}$	0.20	0.83
5th day (during treatment)	$50.45 \pm 0.69_{a}^{w}$	$49.75 \pm 2.23_{a}^{w}$	$50.33 \pm 1.90_{a}^{w}$	0.05	0.96
11th day (during treatment)	$49.45 \pm 3.05_{a}^{w}$	$50.97 \pm 2.27_{a}^{w}$	$50.20 \pm 2.18_{a}^{w}$	0.09	0.92
Day of estrus	$50.67 \pm 3.10_{a}^{w}$	$51.98 \pm 1.02_{a}^{w}$	$51.24 \pm 0.37_{a}^{w}$	0.12	0.89
30th day Post-service	$42.25 \pm 1.23_{a}^{x}$	$43.93 \pm 0.67_{a}^{x}$	$43.98 \pm 0.73_{a}^{x}$	0.17	0.34
F value	2.26*	2.98*	3.51*	--	--
P value	0.05	0.03	0.02	--	--

Mean values bearing different superscripts within a column (w, x) and subscripts within a row (a, b) differ significantly (*$p < 0.05$, **$p < 0.01$).

Table 3: Serum Total protein concentration (g/dl) at different time intervals/days in treatment and control groups of Surti does (Mean ± SEM)

	Groups/treatment (n=6)				
Days of Treatments / Breeding	*G1 Sponge with GPG*	*G2 GPG alone*	*G3 Control*	*F value*	*P value*
0 day	$7.63 \pm 0.54_{a}^{w}$	$7.52 \pm 0.16_{a}^{w}$	$7.66 \pm 0.45_{a}^{w}$	0.03	0.97
5th day	$7.53 \pm 0.35_{a}^{w}$	$7.45 \pm 0.55_{a}^{w}$	$7.57 \pm 0.27_{a}^{w}$	0.02	0.98
11th day	$7.48 \pm 0.53_{a}^{w}$	$7.41 \pm 0.36_{a}^{w}$	$7.51 \pm 0.16_{a}^{w}$	0.02	0.98
Day of estrus	$7.46 \pm 0.14_{a}^{w}$	$7.40 \pm 0.27_{a}^{w}$	$7.53 \pm 0.42_{a}^{w}$	0.05	0.95
30th day post-service	$7.43 \pm 0.28_{a}^{w}$	$7.48 \pm 0.50_{a}^{w}$	$7.40 \pm 0.44_{a}^{w}$	0.01	0.99
F value	0.04	0.02	0.07	--	--
P value	0.99	1.00	0.99	--	--

Mean values bearing common superscript within a column (w) and subscripts within a row (a) do not differ significantly ($p > 0.05$).

Table 4: Serum Cholesterol concentration (mg/dl) at different time intervals/days in treatment and control groups of Surti does (Mean ± SEM)

	Groups/treatment (n=6)				
Days of Treatments / Breeding	*G1 Sponge with GPG*	*G2 GPG alone*	*G3 Control*	*F value*	*P value*
0 day	$93.51 \pm 3.86_a^Y$	$94.62 \pm 7.23_a^X$	$94.62 \pm 4.83_a^X$	0.01	0.98
5th day	$94.15 \pm 2.08_a^Y$	$95.89 \pm 2.47_a^X$	$95.57 \pm 1.65_a^X$	0.19	0.82
11th day	$104.06 \pm 1.80_a^X$	$103.71 \pm 7.64_a^{XW}$	$105.71 \pm 7.86_a^{XW}$	0.02	0.97
Day of estrus	$114.06 \pm 2.90_a^W$	$113.62 \pm 1.44_a^W$	$116.59 \pm 7.12_a^W$	0.12	0.88
30th day Post-service	$93.12 \pm 4.15_a^Y$	$94.42 \pm 6.32_a^X$	$94.49 \pm 5.56_a^X$	0.02	0.98
F value	8.76**	2.16*	2.77*	--	--
P value	0.00	0.10	0.04	--	--

Mean values bearing different superscripts within a column (w, x, y) and subscripts within a row (a, b) differ significantly (*p < 0.05, **p < 0.01).

Serum Glucose

The mean serum glucose concentration of Surti does did not differ significantly between G1, G2 and G3 groups at any of the periods. However, there was a significant decrease in serum glucose at 30th day post-estrus before level as compared to other periods in all the groups (Table 2). Similar period effect on blood glucose was also recorded by Dehury *et al.* (2017) in Black Bengal goats using 30 mg FGA sponge for 14 days.

The mean serum glucose level found on the day 0 and day of estrus compared well with report of Dehury *et al.* (2017) in Black Bengal goats using 30 mg FGA sponge for 14 days, but was lower than and 58.10 and 70.96 mg/dl observed by Saribay *et al.* (2019) in Damascus goats 30 mg FGA sponge for 12 days. Sitaresmi *et al.* (2017) also recorded intermediate values of blood glucose between present and Saribay *et al.* (2019)'s findings.

The serum glucose level of 43.98 ± 0.67 mg/dl observed at 30th day post- estrus was comparatively lower than the values reported by Dehury *et al.* (2017) at 23rd day of post-mating in Black Bengal goats; Khan and Ludri (2002) at 42 to 56 days of gestation in Alpine x Beetal and Sannen x Beetal goats, and Pandya (2009) at 30th day post-estrus in Surti goats, respectively. Significantly lower mean serum glucose level found at 30th day post-estrus might be due to establishment of pregnancy in most of the does with greater utilization of blood glucose.

Serum Total Protein

The mean serum total protein concentration of Surti does under study neither differed significantly between G1, G2 and G3 groups at any of the intervals nor between intervals/periods within the group (Table 3).

The gradual and non-significant decline in the mean serum total protein levels over the study period in different groups was in accordance with the values and trend recorded using 350 mg natural progesterone sponge and 30 mg FGA sponges kept for 14 days by Gangaram (2014) in Osmanabadi goats and Dehury *et al.* (2017) in Black Bengal goats, respectively.

The serum total protein level of 7.40 ± 0.44 g/dl recorded at 30th day post- estrus was lower than reported by Pandya (2009) at 30th day post-estrus in Surti goats.

Serum Cholesterol

The mean serum cholesterol concentration of Surti does did not differ significantly (p>0.05) between G1, G2 and G3 groups at any of the intervals/periods while the differences between periods within the group were significant in all three groups. The mean serum cholesterol concentrations increased gradually and significantly (p < 0.01) on 11th day and further on the day of estrus as compared to levels at days 0/5th, and again dropped to basal level on day 30th post-estrus/mating (Table 4). Similar trend of serum cholesterol concentration was reported by Gangaram (2014) with the use of 350 mg natural progesterone sponge for 14 days in Osmanabadi goats. However lower values of cholesterol were reported by various workers during estrus synchronization in different breeds (Saribay *et al.* 2019; Dehury *et al.* 2017; Patil *et al.* 2000 and Juma *et al* 2009)

The gradual rising trend seen in mean serum total cholesterol level in the sponge plus GPG and GPG group alone might be due to exogenous administration of GnRH at the time of initiation of the treatment was suggestive of follicular activity following steroidogenesis. Steroid hormones have a direct relationship with cholesterol metabolism (Hafez and Hafez, 2000). Higher cholesterol level in the cycling animals is indicative of more secretion of steroid during estrus due to increased ovarian activity.

The serum cholesterol level of 94.49 ± 5.56 mg/dl at 30th day post-estrus observed was at par with 96.27 ± 1.5 mg/dl as reported Dehury *et al.* (2017) at 23rd day of post-mating in Black Bengal goats, but was higher than 79.48 ± 14.93 mg/dl, 76.35 ± 1.98 mg/dl and 64.75 ± 2.89 as reported by Sandabe *et.al.* (2004), Juma *et al.* (2009) and Pandya (2009) respectively during early pregnancy in different goat breeds. The decreasing trend of serum cholesterol concentration from day of estrus to 30th day post-estrus in all the groups seen in present study as well as by various research works

might be due to conception and as pregnancy advances the animals have high levels of circulating progesterone concentration that is extension of the luteal phase causing decline in cholesterol levels.

Conclusion

Synchronization protocols of GPG alone and GPG with intravaginal progestagen sponge in goats did not significantly alter serum levels of glucose, total protein and cholesterol, but effectively minimized the variation of total cholesterol on the day of estrus.

Acknowledgement

The authors are thankful to Director, ICAR-CIRG, Makhdoom, Mathura (UP), as well as Dean & Principal, Veterinary College and Research Scientist, Livestock Research Station, NAU, Navsari for providing necessary facilities and support for conducting this study.

References

Dehury, K.C., Patra, B.K., Sathapathy, S., Nayak, K., & Naik, S.S. (2017). Studies on the alterations of hormonal and biochemical parameters and conception rate in cyclic Black Bengal goats (Capra hircus) by using different hormonal protocols. *Global Journal of Bio-Science and Biotechnology, 6*(2), 275-280.

Gangaram, B.R. (2014). Studies on Estrus induction in Osmanabadi goats. Ph. D Thesis submitted to Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar, India.

Goel, A.K., Kharche, S.D., Jindal, S. K. and Sinha, N. K. (2003). Estrus synchronization efficacy of PGF2α in cyclic goat. In: Proceeding of IAAVR and Indian veterinary congress IV Vetex, April 14-15, Abstract No. 03-46.

Hafez, E.S.E., & Hafez, B. (2000). Reproduction in Farm Animals. Philadelphia: Pennsylvania, USA.

Juma, F.T., Maroff, N.N., & Mahmood, K.T. (2009). Effect of some hormones on reproductive performance and some serum biochemical changes in synchronized black goats. *Iraqi Journal of Veterinary Sciences, 23*(2), 57-61.

Khan, J.R., & Ludri, R.S. (2002). Changes in blood glucose, plasma non-esterified fatty acids and insulin in pregnant and non-pregnant goats. *Tropical Animal Health and Production, 34*(1), 81-90.

Kharche, S.D., Goe,l A.K., Jindal, S.K. &Sinha, N.K. (2002). Estrous response to different synchronization agents in non-describe goat. In: Proceedings of the XVIII Annual Convection of Indian Society for Study of Annual Reproduction and National Symposium in Reproductive Technology for Augmentation of fertility in Livestock, IVRI, Izatnagar, November 14-16, pp. 42-45

Pandya, U.D. (2009). Blood biochemical profiles during different stages of gestation and postpartum in sheep and goat. *M.V.Sc. Thesis*, Anand Agricultural University, Anand, India.

Patil, A.D., Kurhe, B.P., Phalak, K.R., & Dhoble, R.L. (2000). Influence of synchronization treatments on serum total protein and cholesterol levels in Osmanabadi goats. *Indian Journal of Animal Reproduction, 21*(2), 103-104.

Sandabe, U.K., Mustapha, A.R., & Sambo, E.Y. (2004). Effect of pregnancy on some biochemical parameters in Sahel goats in semi-arid zones. *Veterinary Research Communications, 28*(4), 279-285.

Sarıbay, M.K., Naseer, Z., Doğruer, G., Özsoy, B., & Ateş, C.T. (2019). Variations in serum metabolites in response to season, cyclicity, and pregnancy in estrus-synchronized Damascus goats. *Tropical Animal Health and Production, 51*, 1-7.

Sitaresmi, P.I., Widyobroto, B.P., Bintara, S., & Widayati, D.T. (2017). Progesterone and biochemical profile of Ettawa-Saanen crossbreed goats in Turi Area, Yogyakarta-Indonesia. *International Journal of Dairy Science, 12*(4), 289-294.