The Indian Journal of Animal Reproduction; 28(2): 91-95; Dec. 2007 **Short Communication**

Total plasma cholesterol profile in superovulated crossbred cattle

UTSAV SHARMA[1], S.N. MAURYA[2], SURESH KUMAR[3] AND A.K. RAWAT[4]

Govind Ballabh Pant University of Agriculture and Technology, Pantnagar,
Uttarakhand – 263 145, India.
suresh_vet079@rediffmail.com

ABSTRACT

Crossbred cows (n = 24) were divided in to 4 groups. The animal of each group were treated on day 7 (day 0= day of estrous) with different hormonal preparation *viz* 500 I.U. hCG (Group 1), 5 mg *Estradiol valerate* (Group II), 10 ig GnRH (Group III) and 1 ml NSS (Group IV). Animal in each group were superovulated on day 10 of estrous cycle with FSH-P. The superovulatory response was determined by counting corpora lutea present on both the ovaries. Total cholesterol level increased significantly (P<0.05) on the day of superovulatory estrus in group I, II and IV and non-significantly (P>0.05) in group III. Positive (P < 0.01) correlation existed between ovulation rate and total cholesterol on day 4. This correlation was also significant (P<0.05) on day 4 to 7 of estrous cycle, day of initiation of gonadotropin treatment, day of PGF$_2$á injection, at superovulatory estrus and on day 7 post superovulatory estrus.

Key words: Cholesterol, Superovulation Cattle

Blood cholesterol plays a vital role in the physiology of reproduction. Its concentration has been reported to have positive relationship with energy/health status of animals (Robinson, 1957; Velhankar, 1973) resulting in better reproductive performance (Velhankar, 1973; Shahukar *et al.*, 1985, Aminudeen *et al.*, 1984).

Furthermore high level of cholesterol has also been detected at superovulatory estrus than at spontaneous estrus (Kharche, 1989; Prasad, 1990). In the present study the level of blood plasma total cholesterol and its correlation with ovulation rate was evaluated before, during and after gonadotropin treatments in crossbred cows.

Twenty four healthy cross bred cows between 3 to 7 years of age from Instructional Dairy Farm of the University with regular estrous cycle were included in the study. The animals were divided into 4 groups consisting of six animals in each group.

The animals of each group were on day 7, treated with different hormonal preparations viz.

Group I. :500 IU hCG (Human Chorionic Gonadotropin),

Group II:5 mg EV (*Estradiol valerate*),

Group III:10 ig GnRH (*Buserelin Acetate*)

Group IV: Served as control and was injected with 1 ml NSS, all by I/M route.

Animals in each group were superovulated on day 10 of estrus cycle (day 0 = day of estrus) with multiple injections of FSH-P (Folltropin-V, Vetrephara, Canada) given at 12 hours interval in 8 divided doses in tapering schedule *i.e.* 65, 65; 55, 55; 45, 45; 35, 35; mgs by intramuscular route. An intramuscular injection of Lutalyse 25 mg (*Dinoprost tromethamine*) was given along with fifth injection of FSH-P to

[1] Asstt. Professor, S.K.A.U.S.T. (J) [2]Retd. Professor [3]Senior Scientist(AR) Sikkim Centre,ICAR [4]Teaching Personal

induce the luteolysis.

Animals were bled on day 4, 5, 6 and 7 of estrous cycle, on the day of initiation of gonadotropin treatment (*i.e.* day 10 of estrous cycle), on the day of PGF_2á? treatment (*i.e.* day 12 of estrous cycle), on the day of onset of superovulatory estrus (*i.e.* day 14/15) and on day 7 post superovulatory estrus (*i.e.* day of embryo collection). Plasma was harvested and stored at 20°C pending analysis. The estimation of cholesterol in blood plasma samples was done using Span Diagnostic Kits (Span Diagnostics Ltd., Udhna, Surat, India) on spectrophotometer (Model, GS 5705, EC India Ltd.).

In the present study, results were are in agreement to those reported by Memon and Mullick (1960), Awasthi and Kharche (1987) and Dutta *et al.*, (1988). However, these values were lower than those reported by Agarwal *et al.*, (1982). The concentration of total cholesterol on day 4, 5, 6 and 7 of the estrous cycle between and within groups did not differ significantly ($P > 0.05$) (Table -I). Similar trend was observed in values of pooled data ($n = 24$). This might be due to similar hormonal profile during the early oestrous cycle. The concentration of cholesterol increased on the day of gonadotropin treatment in all the groups though non-significantly ($P > 0.05$), similar to findings of Kumar (2002).

The blood plasma cholesterol concentration increased marginally on day of PGF_2á injection, similar to the findings of Kharche *et al.*, (1989) and Kumar (2002). The value reached significantly high level on the day of superovulatory estrus in group I, II, IV and in values of pooled data. However, the increase in group III was non-significant ($P > 0.05$). The high cholesterol level during estrus may be due to increased synthesis of estrogens (Beitz and Allen, 1984). Add interpretation of EV administered group. Bhattacharya *et al.*, (1972) and Deopurkar (1974) also found higher cholesterol during estrus and significantly low values during luteal phase and in anoestrus cows. Fillois *et al.*, (1958) reported increased cholesterol in ovarectiomized rats following the administration of estradiol 17-b

Following estrus, the concentration of total cholesterol decreased significantly ($P< 0.05$) in groups I, II, IV and in values of pooled data and non-significantly in group III and reached the pretreatment levels on day 7 post superovulatory estrus, similar to finding of Kumar (2002) who also reported a decreased level of cholesterol on day 7 post superovulatory estrus.

Correlation of blood plasma total cholesterol level on day 4 with ovulation rate was highly significant ($P < 0.01$) and was positively correlated ($P < 0.05$) on day 5 and 7 of the estrous cycle (Table II). However, Kumar (2002) reported a non-significant correlation at day 7. Correlation of total cholesterol level on the day of initiation of gonadotropin treatment, day of PGF_2á injection at superovulatory estrus and days 7 post superovulatory estrus was significant ($P< 0.05$) in agreement with the results of Maruo *et al.*, (1987) and also positively correlated.

Low total cholesterol might indicate health energy status of the donors which in turn would affect the follicular and oocyte maturation, resulting in poor ovulation and embryo yield. A low energy diet (Dufour *et al.*, 1981), faulty metabolism (Schaffer *et al.*, 1990), physiological stress (Aminudeen *et al.*, 1984), fatty liver or fat cow syndrome (Reid and Roberts, 1982) have all been suggested to be causative factors for low total cholesterol level in animals.

However, the role of total cholesterol in the reproduction in cattle needs detailed biochemical studies involving fat supplementation in relation to blood plasma cholesterol in dairy animals with particular reference to superovulatory response. In conclusion, the present study confirms earlier reports (Kweon *et al.*, 1985; Kweon *et al.*, 1987; Mauro *et al.*, 1987; Schaffer *et al.*, 1990) that low cholesterol level may adversely affect ovarian response. Thus preliminary selection of potential donors based on total cholesterol concentration is suggested for use in predicting ovarian response after gonadotropin treatment.

Table I: Change in mean concentration of blood plasma total cholesterol (mg/dl) before, during and after gonadotropin treatment in embryo donor cattle

Treatment groups	Day of blood sampling							
	Day 4	**Day 5**	**Day 6**	**Day 7**	**Initiation of Gonadotropin treatment**	**$PGF_2\alpha$ treatment**	**Superovulatory estrus**	**Day 7 post superovulatory estrus**
Group I (hCG)	122.30^{A} ±2.48	124.98^{AB} ±2.71	125.80^{AB} ±2.44	126.58^{AB} ±2.49	135.19^{BC} ±3.20	139.65^{C} ±3.63	172.84^{D} ±6.35	137.53^{C} ±3.99
Group II (EV)	133.27^{A} ±4.98	135.19^{A} ±5.13	137.05^{AB} ±5.62	139.81^{ABC} ±5.41	147.79^{ABC} ±5.15	152.40^{BC} ±4.97	180.60^{D} ±7.06	154.95^{C} ±5.11
Group III (GnRH)	124.58^{A} ±6.22	124.79^{A} ±5.90	127.12^{A} ±6.40	129.63^{A} ±6.77	134.76^{A} ±6.44	140.05^{A} ±6.54	152.91^{A} ±8.09	133.80^{A} ±7.72
Group IV (control)	134.15^{A} ±5.55	135.80^{AB} ±5.48	141.78^{ABC} ±3.73	141.40^{ABC} ±6.12	146.79^{ABC} ±6.05	150.95^{BC} ±5.84	173.45^{D} ±5.99	152.68^{C} ±7.20
Total (n = 24)	128.58^{A} ±2.57	130.19^{A} ±2.56	134.62^{AB} ±2.69	134.35^{AB} ±2.86	141.13^{BC} ±2.81	145.76^{C} ±2.78	169.95^{D} ±3.93	144.74^{C} ±3.47

Means within a Column are statistically non-significant (P > 0.05)
Means within a row with different superscripts are significantly different (P < 0.05)

Table 2: coefficient of correlation between ovulation rate and blood plasma cholesterol (pooled data) in embryo donors

Treatment groups	Day of blood sampling							
	Day 4	**Day 5**	**Day 6**	**Day 7**	**Initiation of Gonadotropin treatment**	**$PGF_2\alpha$, treatment**	**Superovulatory estrus**	**Day 7 post superovulatory estrus**
Total cholesterol	0.535**	0.410*	0.333	0.464*	0.491	0.477*	0.448*	0.438*

•Indicates significance at 5% (P < 0.05)
** Indicates significance at 1% (P < 0.01)

ACKNOWLEDGEMENT

Author is thankful to Dean, College of Veterinary and Animal Science and Director Experiment Station, G.B. Pant University of Agriculture and Technology, Pantnagar, for providing necessary facilities to carry out this work. Financial assistance provided by NATP (ICAR) and U.P. Government is sincerely acknowledgement.

REFERENCES

Agarwal, D.K., Tripathi, S.S. and Saxena, V.B. (1982). Studies on progesterone and certain biochemical constituents of blood serum during estrous cycle of cross-bred cows and buffaloes. Indian J. Anim. Res. **16** (2) : 107-112.

Aminudeen,R., Pareek, P.K. and Ghosal, A.K. (1984). Blood profiles in normal and anestrous Rathi cows of arid tract of Rajasthan. Indian J. Anim. Sci. **54** (8): 751-757.

Awasthi, M.K.and Kharche, K.G. (1987). Studies on some blood constituents in normal cycling and infertile

repeat breeder crossbred cows. Indian J. Anim. Reprod. **8** (2): 95-97.

Baruah, K.K., Baruah, R.N.,Baruah, K.K., Baruah, B. and Baruah, A. (1993). Studies on certain blood constituents on the day of first estrus in Jersey heifers fed with different levels of dietary protein. Indian J. Anim. Reprod. **14** (2): 85-87.

Beitz, D.C. and Allen, R.S. (1984). Lipid metabolism. *In:* Dukes physiology of Domestic Animals. 10th ed. Comstock publishing Associates. London, pp. 393-394.

Bhattacharya, A.P., Luktuke, S.N. and Pal, A.K. (1972). Studies on bloodcholestrol in relation to estrous cycle in bovine. FAG Swedish Folloe-Up Seminar on Animal Reproduction. Bangalore.

Bloch, K. and Rittenberg, D. (1942). The utilization of acetic acid for cholesterol formation. J. Biol. Chem. **145:** 625-636.

Deopurkar, V.L. (1974). Study of some remedial measures in post-partum anestrous condition of Gir cows with special reference to blood cholesterol level and vaginal cytology. M.V. Sc. Thesis. Konkan Krishi Vidhyapeeth, Dapoli.

Dufour, J.J., Adelakoun, V. and Malton, P. (1981). Limited multiple ovulation in heifers fed with high plane of nutrition before PMSG stimulation and steroid hormone concentration in single, twin and multiple ovulators. Theriogenology. **15:** 433-441.

Dutta, J.C., Baruah, R.N., Dutta, L. and Talukdar, S.C. (1988). Blood biochemical studies in anestrous and normal cyclic cattle. Indian Vet. J. **65**: 239-241.

Fillios, L.C., Kaplan, R., Marlin, R.S. and stare, F.J. (1958). Some aspects of the gonadal regulation of cholesterol metabolism. Am. J. Physiol. **193**: 47-51

Kharche, S.D. (1989). studies on superovulation and hormonal profile in crossbred cattle. M.V.Sc. Thesis. Indian Veterinary Research Institute, Izatnagar, U.P .

Kumar, Naveen. (2002). Studies on superovulatory response in Sahiwal and Crossbred cows following human chorionic gonadotropin (hCG) and estradiol pretreatment. M.V.Sc. thesis, G.B.Pant University of Agriculture and Technology, Pantnagar, Uttaranchal.

Kweon, O.K., Kanagawa, H., Takahashi, Y., Miyamato, A., Masak, J., Umezer, M., Kagabu, S., Iwazumi, Y. and Aoyagi. (1987). Plasma endocrine profiles and total cholesterol levels in superovulated cows. Theriogenology. **27**: 841-857.

Kweon, O.K., Ono, H., Yamashina, H., Seike, N., Mori, K. and Kanagawa, H. (1985). Relationship between serum total cholesterol and progesterone levels and the number of transferable embryos in super ovulated Holstein heifers and cows. Japanese J. Anim. Reprod. 31: 231-233.

Maruo, Y., Sawada, T., Inaba, T. , Konishi, Saito, N. and Mori, J. (1987). Relationship between total cholesterol level and ovarian response in super ovulated Japanese Black Cow. Japanese J. Zootechnical Sci. 58: 711-713.

Memon, G.N. and Mullick, D.N. (1961). Blood composition of growing calve and pregnant And lactating cows. Indian J. Physiol. and Allied Sci. 95 (4): 101-110.

Prasad, D.M. (1990). Effect of superovulation and non-surgical embryo recovery on subsequent reproductive performance in crossbred cattle. M.V. Sc. Thesis, Indian Veterinary Research Institute, Izatnagar.

Reid, I.M. and Roberts. (1982). Fatty liver in dairy cows. Vet Practice. 43: 164-169.

Robinson, T.J. 1957. Pregnancy in the progress. *In:* Hammond, J. (ed) Physiology of farm animals. 3. Butterworths, London. 1957, pp. 793-904.

Roussel, J.D., Aranas, J.J. and Seybt, S.H. (1982). Metabolic profile testing in Holstein cattle in Louisiana: Reference Values. Am. J. Vet.Res. 43 (9): 1658-1660.

Schaffer, M., Hein, T.T., Paarman, S. and Kramer, C. (1990). Relationship of metabolic status with embryo recovery in high yielding cows. Archive Fur. Expt. Veterinarmedizin. 44: 157-162.

Shahukar, C.S., Pandit, R.K., Chauhan, R.A.S. and Porwal, M.C. (1985). Cholesterol and AKP during various reproductive phases in crossbred cows. Indian J. Anim. Sci. 55: 421-423.

Snedecor, G.W. and Cochran, W.G. (1968). Statistical methods. 6th edition (Ind.), Oxford and IBH Publishing Co. 66, New Delhi, India.

Velhankar, D.P. (1976). Growth, puberty and sexual maturity in Gir heifers consequential to different dietary energy levels with critical studies on blood glucose, copper, cholesterol and haemoglobin polymorphism. Ph.D. Thesis. Konkan Vidhyapeeth, Depoli, Maharashtra, India.

INSTRUCTIONS FOR SUBSCRIBERS

The manuscripts should be e-mailed to us on the address *editorijar@yahoo.co.in*. The authors are requested to get their manuscripts pre-reviewed at least by two specialists on the field. We would appreciate if the language corrections are also made through English teacher or language specialist, so that we do not have any difficulty in submitting them to some foreign reviewers. The hard copy should be accompanied by the Author Declaration Certificate indicating Life Membership no of first author, Compact Disk (CD) in MS word and figures and photographs in JPEG format all in separate file. The tables and figures should be submitted in separate files / folders so that we could minimize the cost of the journal. All the subscribers are requested to give atleast 5-10 names of specialists not below the rank of Professor /Chief Scientists / Principal Scientists in order to make a reviewers directory. We would appreciate full addresses along with e-mail, fax, and mobile phone numbers on the manuscript. All correspondence should be made through e mail, alongwith the article reference no. for any confirmation.

Editor IJAR