SEASONAL VARIATIONS IN BLOOD PLASMA TOTAL PROTEIN AND CHOLESTEROL CONCENTRATIONS IN CROSSBRED CATTLE (HOLSTEIN FRIESAN x THARPARKAR) DURING TRANSITION PERIOD[#]

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Received on: 07.06.2018
Accepted on: 18.08.2018

ABSTRACT

The present study was to investigate the effect of season on alterations in concentrations of total protein (tP) and cholesterol (tCh) in blood plasma in crossbred dairy cows during transition period. The study was conducted on a total of 12 peri-parturient cross bred dairy cows of 2nd to 5th parity during summer and winter seasons. Groups of 6 cows each were studied during each season. During summer (June to August) and winter (November to January), mean temperature recorded was 30.28°C (maximum: 34.40°C and minimum: 26.17°C) and 15.94°C (maximum: 23.19°C and minimum: 8.70°C), respectively. Blood samples were collected at fortnight interval starting from 3 weeks before and continued up to 3 weeks after calving. Student's t-test was performed for statistical comparison of data recorded during the experiment at different fortnights. The difference was considered to be significant at $P<0.05$. The results showed significant ($P<0.05$) differences between the concentrations of tP measured at different fortnight during summer and winter season. The overall mean concentrations of tP measured throughout the whole experimental period both during summer and winter season were also found to be significantly ($P<0.05$) higher during winter than summer (7.92 ± 0.40 vs. 6.72 ± 0.20 g/dl). Concentrations of tCh were found to be significantly ($P<0.05$) higher at 21 days after calving during winter as compared to summer season (106.11 ± 7.51 vs. 85.24 ± 4.52 mg/dl). The overall mean concentrations of tCh measured throughout the entire study period during summer and winter season were numerically higher during winter as compared to summer season. It can be concluded that the pattern of change in concentrations of tP and tCh are affected by physiological changes during transition period which are further affected by prevailing seasonal variations.

Key words: Crossbred cows, total cholesterol, total protein, transition period, season

Introduction

Seasons influence a large number of blood biochemical parameters which correspond to change in physiological attributes during different seasons in livestock species (Alberghina *et al*., 2010 and Piccione *et al*., 2009). Total protein and cholesterol concentrations have been found to be significantly differed between summer and winter season in non-pregnant Holstein heifers (Rasouli *et al*., 2004). It has been observed that studies on seasonal variations in blood plasma concentrations of tP and tCh are very scanty during transition period in crossbred dairy cattle. Therefore, the present study was conducted to investigate the effect of different seasons on change in concentrations of blood plasma tP and tCh concentrations in crossbred cattle during transition period.

Materials and Methods

The experiment was conducted at Livestock Research Center of ICAR-National Dairy Research Institute, Karnal, Haryana. The maximum ambient temperature of Karnal in summer goes up to 45°C and minimum temperature in winter comes down to 2°C with a diurnal variation in the order of 15-20°C.

Animal ethics approval

Experiment was approved and conducted under the established standard of the Institutional Animal Ethics Committee (IAEC).

Selection and management of animals

For the study, a total of 12 pre-parturient cross bred Karan Fries cows (Holstein Friesan x Tharparkar) were selected from the herd maintained at Livestock research centre, ICAR-NDRI, Karnal. The experiment was conducted during 2 seasons i.e., during summer (June to August) and winter season (November to January). The cows selected during summer and winter season were 21 days before their expected day of calving. During each season, a group of 6 cows was taken for the study in such a way that one group of 6 cows was studied during summer season and other group of 6 cows was studied during winter season. Cows between 2nd to 5th parity were kept in each group. The experimental cows were maintained in loose housing system both during summer and winter season. Cows under study were maintained as per the standard conditions of feeding and management followed at NDRI. All the animals were fed a ration consisting of concentrate mixture and roughages available at farm both during summer and winter season. Fresh tap water was available for drinking throughout the time to all the cows.

Environmental variables

Daily maximum temperature ($T_{max.}$), minimum temperature ($T_{min.}$), maximum relative humidity ($RH_{max.}$) and minimum relative humidity ($RH_{min.}$) were recorded during the entire study period of both seasons.

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Blood collection and analysis

The blood samples were collected at fortnight interval starting from 21 days before and continued up to 21 days after calving. Blood samples were collected at 0700 h before feeding. 5 ml blood sample was collected from each cow by jugular venipuncture in sterile heparinized vacutainer tubes. Immediately after collection, blood samples were gently brought to the laboratory in chilled ice-box and centrifuged at 2500 rpm for 15 minutes in refrigerated centrifuge at 4°C. The blood plasma was harvested and stored at -20°C until analyzed for tP and tCh. Total protein was estimated in the blood plasma of experimental cows by using "Autospan Liquid Gold Total Protein" (Catalog No.83-LS100-60) modified biuret end point assay supplied by ARKRAY Healthcare Pvt. Ltd. For estimation of total cholesterol, "Autospan Liquid Gold Cholesterol" (Catalog No.71-LS200-40) CHOD-PAP enzymatic end point assay supplied by ARKRAY Healthcare Pvt. Ltd. was used.

Statistical analysis

For statistical comparison of data recorded during the experiment at different fortnights, student's t-test was performed to statistically compare the concentrations of tP and tCh in blood plasma between cows of summer group and winter group by using SPSS statistical software program (version 21.0). The difference at $P<0.05$ was considered to be significant.

Results and Discussion

Environmental variables

Mean ± S.E. maximum and minimum temperature (°C) and relative humidity (%) during summer and winter season are shown in Table 1, Figure 1 and Figure 2. Mean temperature recorded during summer season was 30.28°C ranging from maximum temperature of 34.40 ± 0.35°C to minimum temperature of 26.17 ± 0.15°C. Mean relative humidity recorded during summer season was 74.39% ranging from maximum relative humidity of 84.09 ± 1.05% to minimum relative humidity of 64.68 ± 1.82%. During winter season, Mean temperature recorded was 15.94°C ranging from maximum temperature of 23.19 ± 0.49°C to minimum temperature of 8.70 ± 0.31°C. Mean relative humidity recorded during winter season was 74.87% ranging from maximum relative humidity of 94.63 ± 0.93% to minimum relative humidity of 53.11 ± 1.97%. These environment variables indicate the prevailing summer and winter conditions experienced by our experimental cows.

Total protein

Fortnightly Mean ± SE concentrations of tP during summer and winter season in blood plasma of cross bred cows are presented in Table 2 and Figure 3. Our results showed that the concentrations of tP in blood plasma of dairy cows during transition period at different fortnights were found to significantly ($P<0.05$) higher during winter season compared to summer season. We also found that the overall mean tP concentrations measured throughout the whole experimental period during summer and winter season were significantly ($P<0.05$) higher during winter season compared to summer season. Our results of decreasing concentrations of tP as cows were impending to parturition and thereafter increasing post-partum during early lactation are in agreement with Piccione *et al*. (2012) who found similar results in peri-parturient dairy cows. The increase in tP after parturition during both seasons may be due to alterations in metabolic physiology post-partum along with increased rumen microbial protein synthesis during early lactation which may also be linked with changed diet during early lactation (Heck *et al.*, 2009). Our results showed higher tP concentrations during winter season are in agreement with Tajik and Sazmand (2013) who found similar results of increased tP concentrations in blood plasma of dromedary she-camels during winter season as compared to summer season (7.65 ± 0.16 vs. 6.70 ± 0.28 g/dl). However, contrary to this, Rasouli *et al*. (2004) observed decreased concentrations of tP during winter season as compared to summer season.

Total Cholesterol

Fortnightly Mean ± S.E. concentrations of tCh during summer and winter season in blood plasma of cross bred cows are presented in Table 3 and Fig. 4. Our results showed that overall blood plasma tCh concentrations in cross bred dairy cows during transition period were more in winter season compared to summer season. However, the difference was not found to be significant. We also observed that concentrations of tCh before calving and on the day of calving were numerically more during summer season compared to winter season. However, it was observed that increase in tCh concentrations were more rapid after calving during winter season as compared to summer season where we found that on 21 days after calving, the tCh concentrations were significantly ($P<0.05$) higher during winter season. The results of our experiment showed that the pattern of alterations in tCh concentrations in blood plasma of transition cows during both summer and winter season are similar to the pattern of tCh observed by Piccione *et al*. (2012). The increased concentrations of tCh during late gestation as showed in our results are in agreement with Nazifi *et al*. (2002) who observed similar results in Iranian fat tailed sheep from which they quoted that this occurs mainly due to increased synthesis of hepatic triglycerides and VLDL secretion. The phenomenon of altered characteristic lipid metabolism is corresponding to increased lipid reserves during pregnancy which are subsequently utilized after parturition during early lactation. Our results of increased tCh concentrations during winter season as compared to summer season are in agreement with Sandabe and Chaudhry (2000), Rasouli *et al*. (2004) and Tajik and Sazmand (2013) who found similar results in Sahel goats, Holstein heifers and dromedary she-camels, respectively during winter season.

Acknowledgements

The authors would like to thank to the Director, ICAR-NDRI for providing financial support and necessary facilities to conduct this research work.

References

Alberghina D, Casella S, Vazzana I, Ferrantelli V, Giannetto C and Piccione G (2010) Analysis of serum proteins in clinically healthy goats (*Capra hircus*) using agarose gel electrophoresis. *Vet. Clin. Path.* **39**(3):317-321.

Heck JML, Van Valenberg HJF, Dijkstra J and Van Hooijdonk ACM (2009) Seasonal variation in the Dutch bovine raw milk composition. *J. Dairy Sci.* **92** (10):4745-4755.

Nazifi S, Saeb M and Ghavami SM (2002) Serum lipid profile in iranian

Table 1: Mean ± S.E. maximum and minimum temperature (°C) and relative humidity (%) during summer and winter season

Season	$T_{max.}$ (°C)	$T_{min.}$ (°C)	$RH_{max.}$ (%)	$RH_{min.}$ (%)
Summer (June-August)	34.40 ± 0.35	26.17 ± 0.15	84.09 ± 1.05	64.68 ± 1.82
Winter (November- January)	23.19 ± 0.49	8.70 ± 0.31	94.63 ± 0.93	53.11 ± 1.97

$T_{max.}$- maximum temperature; $T_{min.}$- minimum temperature; $RH_{max.}$- maximum relative humidity; $RH_{min.}$- minimum relative humidity

Table 2: Fortnightly Mean ± S.E. concentrations of total protein (g/dl) during summer and winter season in blood plasma of cross bred cows

Days of calving	Summer	Winter
-21	7.45^{a} ± 0.13	9.13^{b} ± 0.84
-7	6.76^{a} ± 0.22	7.39^{b} ± 0.19
0	6.29 ± 0.24	6.94 ± 0.27
7	6.49^{a} ± 0.19	7.58^{b} ± 0.27
21	6.62^{a} ± 0.21	8.55^{b} ± 0.34
Mean ± S.E.	6.72^{a} ± 0.20	7.92^{b} ± 0.40

^{a,b} Means having different superscripts within a row differs significantly (P<0.05)

Table 3: Fortnightly Mean ± SE concentrations of total cholesterol (mg/dl) during summer and winter season in blood plasma of cross bred cows

Days of calving	Summer	Winter
-21	91.48 ± 8.13	83.04 ± 10.55
-7	72.56 ± 6.12	61.91 ± 11.22
0	61.30 ± 4.06	56.86 ± 8.85
7	69.08 ± 4.78	80.96 ± 5.95
21	85.24^{a} ± 4.52	106.11^{b} ± 7.51
Mean ± S.E.	75.93 ± 5.48	77.78 ± 8.75

^{a,b} Means having different superscripts within a row differs significantly (P<0.05)

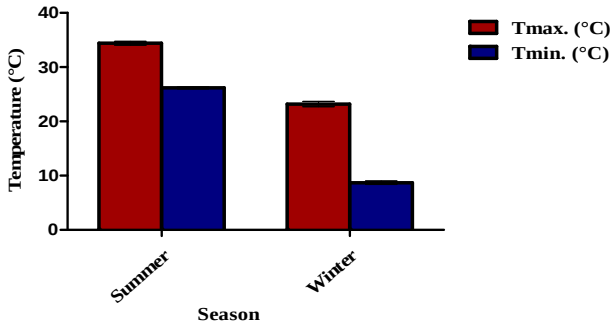

Fig. 1: Mean ± S.E. maximum and minimum temperature (°C) recorded during summer and winter season

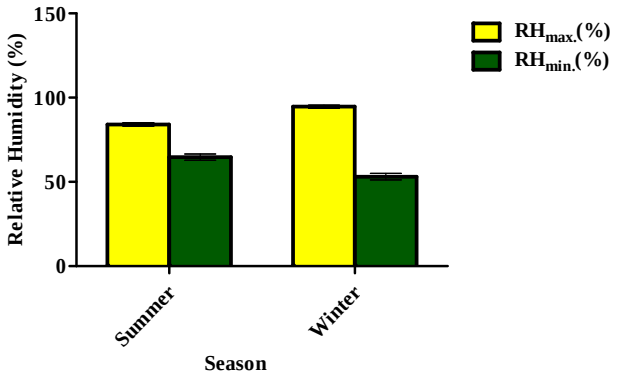

Fig. 2: Mean ± S.E. maximum and minimum relative humidity (%) recorded during summer and winter season

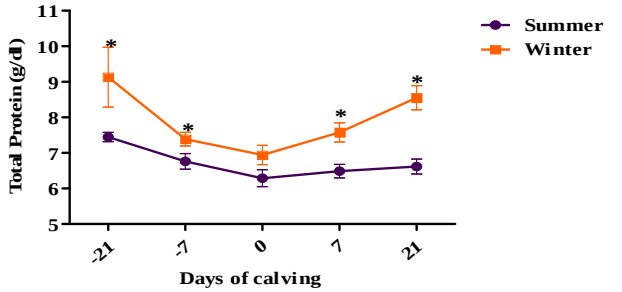

Fig. 3: Fortnightly Mean ± S.E. concentrations of total protein (g/dl) during summer and winter season in blood plasma of cross bred cows (*P<0.05)

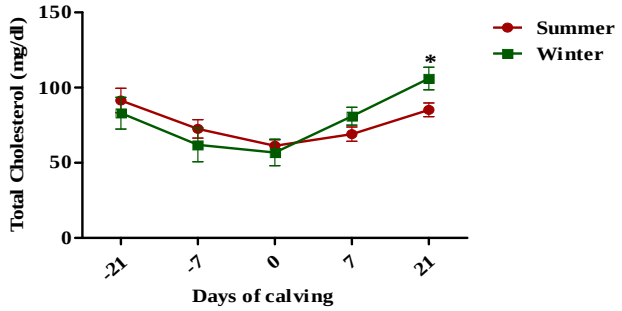

Fig. 4: Fortnightly Mean ± S.E. concentrations of total cholesterol (mg/dl) during summer and winter season in blood plasma of cross bred cows (*P<0.05)

fat tailed sheep in late pregnancy, at parturition and during the post parturition period. *J. Vet. Med. A* **49** (1):9-12.

Piccione G, Giannetto C, Casella S and Caola, G (2009) Annual rhythms of some physiological parameters in *Ovis aries* and *Capra hircus*. *Biol Rhythm Res*. **40** (6):455-464.

Piccione G, Messina V, Marafioti S, Casella S, Giannetto C and Fazio F (2012) Changes of some haematochemical parameters in dairy cows during late gestation, post partum, lactation and dry periods. *Vet. Med. Zoot*. **58**:59-64.

Rasouli A, Nouri M, Khajeh GH and Rasekh A (2004) The influences of seasonal variations on thyroid activity and some biochemical parameters of cattle. *Iran J. Vet. Res*. **5**(2): 55-62.

Sandabe UK and Chaudhry SUR (2000) Effect of environmental temperature on some biochemical values in female sahel goats. *Pak. Vet. J*. **20**(1):10-12.

Tajik J and Sazmand A (2013) Serum concentrations of thyroid hormones, cholesterol and triglyceride, and their correlations together in clinically healthy camels (*Camelus dromedarius*): Effects of season, sex and age. In *Veterinary research forum: an international quarterly journal.* Faculty of Veterinary Medicine, Urmia University, Urmia, Iran. **4** (4):239.