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Seasonal variation on lipoproteins profile of crossbred cattle as an indicator for physiological status assessment

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Abstract
The study was conducted to find baseline data and compared the effect of different season's on blood lipoprotein profile in crossbred cattle's. Ten crossbred Cattle animals with same physiological and nutritional status under same standard practice were selected from the Nagaland university modern dairy farm near Medziphema Nagaland. Stand for temperature humidity index (THI) of spring, summer and winter seasons was calculated with local metrological data. Mean THI values significantly ($p \leq 0.05$) highest in summer season (78.08±0.74) followed by winter seasons (72.66±3.19) and lowest in spring seasons (67.72±3.35), respectively. Blood sample was collection two in each season between 7 AM to 8.30 AM in investigational area. Investigation of the data showed significantly ($p \leq 0.05$) HDL higher in spring followed by summer and winter, LDL higher in summer followed by spring and winter, VLDL lowest in summer followed by spring and summer. Most production of livestock production and productivities are decline when the typical weather condition is not comfortable. On the other hand, universal require for livestock product is expected to increasing in the future due to human population.

Keywords: Cattle, THI, seasons

Introduction
Weather and climate influence both farm animal production and agronomic production. Seasonal change is one of the major risks for survival of various species, ecosystems and the sustainability of livestock production systems across the world, especially in tropical and temperate countries. The evaluation of the physiological status is essential as a reference for the development of different livestock maintenance systems.

Temperature Humidity index in the temperature variation have measureable impact lead stress on crossbred cattle physiological and biological endocrine outline of cattle and increase loss the production system. Lipids, cholesterol and triglycerides are so important in the animal living and they are found in almost all parts of the body. Species within species variation have been recognized to exist in serum triglycerides, cholesterols and lipoproteins concentrations amongst domestic animals (Tajik and Nazifi 2011) [15]. Total protein relaxed is usually used as an indicator of animals' nutritive status reflecting food intake and metabolism.

Heat stress during summer season inhibit appetite centre via satiety centre to decrease feed intake as one of the thermoregulatory mechanisms to decrease metabolic heat production. The blood plasma cholesterol is connected with the different lipoprotein fractions such as LDL, VLDL and HDL cholesterol, VLDL cholesterol being implicated in transportation of tri-acylglycerol from liver to the adipose tissue (Satyanarayana *et al.*, 2006) [14]. The stressful condition of summer leads to decrease of feed intake as thermoregulatory mechanisms to decrease metabolic heat production which lead to lower serum protein concentration during summer (Kalyani *et al.*, 2018) [7].

The cross breeds makes up a higher percentage and they are found in the drier northeast and sub-humid zones of the country. Noted that total cattle population in Nagaland is 76.87 thousands only in and has decreased substantially (383.30 thousand in 1997) of the cattle breed; which population is gradually going into extinction. The production system of crossbred breed differ; in that the former is more of the traveling pattern while the latter is sitting, almost always tethered at grazing and housed in the evenings. Location, season, breed and gender (sex) have influence on the animal physiology and productivity. So this study was to investigate the lipid profile activity of these breed of cattle.

Materials and Methods

The present research was conducted for a period of one year comparative spring (January-April), summer (May to August) and winter (September-December). Ten crossbreed cattle with a standard age of 1.5 -4 years and average body weight of 325-350 kg were selected Nagaland university Medziphema modern dairy farm organized dairy farms near ICAR Complex. Blood samples were collected from jugular vein, two times in each season from all the crossbred cattle. The blood sample were centrifuged at 3000 rpm for 15 minutes at 10 ˚C and serum were into separated into different micro centrifuge tubes and lapelled as par the sample for estimation of different lipoprotein parameters. Serum sample for lipoprotein estimation was stored at -20 °C until the analysis. The blood high density lipoproteins, low density lipoproteins, very low density lipoproteins were estimated using semi automated biochemistry analyzer absorbance was read for standard and test with UV-vis spectrophotometer. The standard kit was procured from DIATEK health care Pvt. Ltd. following the instructions and procedure supplied with the diagnostic kits.

Results and Discussion

The mean concentration of high density lipoprotein was 70.76±8.10, 55.40±2.14 and 47.78±2.95 (mg/dl) in spring, summer and winter seasons, respectively. From statistical analysis, it was found that the concentration of high density lipoprotein was significantly (p<0.05) higher in spring season (70.76±8.10 mg/dl) followed by summer season (55.40±2.14 mg/dl) and lower in winter season (47.78±2.95 mg/dl). However, there was no significant difference between winter and summer seasons. Which could be attributed to highest total cholesterol during summer followed by winter season as the HDL cholesterol is implicated in reverse transportation of cholesterol for its degradation and elimination from the body, HDL-cholesterol being good cholesterol indicate the beneficial effect of antioxidant supplementation and management practices.

Table 1: Local climatic parameters during different seasons of experimental period (THI Values)

Seasons	Air Temperature (°C)			Relative humidity (%)			THI Value
	Max.	Min.	Mean	Max	Min.	Mean	Mean
Spring	27.25 (22.7-32.2)	13.77 (9.6-19.9)	20.51	92.75 (90 - 96)	53 (40 - 68)	72.87	67.72
Summer	32.2 (30.5-33.0)	23.62 (21.9-24.6)	27.51	93.25 (92 - 95)	70.5 (69 - 72)	81.87	78.08
Winter	29.4 (25.7-33.0)	17.9 (11.7-23.8)	23.65	94.25 (91 - 96)	62.25 (53 - 69)	78.25	72.66

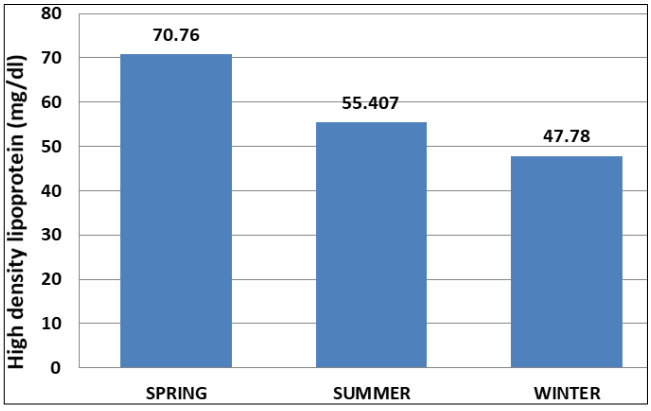

Fig 1: High density lipoprotein (mg/dl) in crossbred cattle during different seasons

The finding of the present study was well corroborated with the observation of Gurubasayya and Kalmath (2013) [6] who had also observed the concentration of high density lipoprotein was significantly (p<0.05) highest during summer seasons followed by winter in hallikar cattle. Kreindl *et al.* (2014) [9] reported that the HDL levels was significantly (p<0.05) lowest in winter followed by summer in young adults cattle. Das *et al.* (2013) [2] also reported significantly (p<0.05) highest summer HDL levels in buffaloes supplemented with niacin. Malmsten *et al.* (2007) [11] reported that the HDL level highest during summer followed by winter seasons in mammals. Lupoli *et al.* (2010) [10] reported that the HDL levels was significantly (p<0.05) lowest in winter followed by summer in male sheep. These findings were in contrast with Kanwar *et al.* (2016) [8] reported that the HDL levels was significantly (p<0.05) highest in winter followed by summer in murrah buffalo due to different in dietary intake, metabolic difficulty and THI factors between the seasons.

The mean concentration of low density lipoproteins was 76.30±6.38, 102.75±2.03 and 73.24±3.64 (mg/dl) in spring, summer and winter seasons, respectively. From statistical analysis, it was found that the concentration of low density lipoproteins was significantly (P<0.05) highest in summer season (102.75±2.03 mg/dl) followed by spring season (76.30±6.38 mg/dl) and lowest in winter season (73.24±3.64 mg/dl) However, there was no significant difference between spring and winter seasons. This low density lipoproteins concentration highest in summer season might be due to correspondingly highest levels of circulating total cholesterol in animal body.

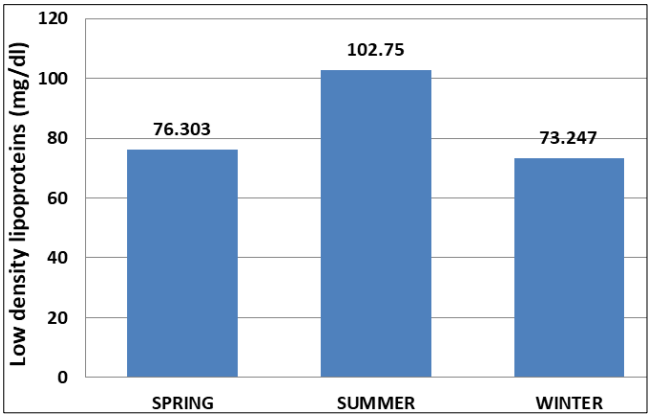

Fig 2: Low density lipoproteins (mg/dl) in crossbred cattle during different seasons

The finding of the present study was well corroborated with the observation of Gurubasayya and Kalmath (2013) [6] who had also observed the low density lipoproteins was significantly (p<0.05) highest concentration during summer seasons followed by spring and winter seasons in hallikar cattle. Satyanarayana *et al.* (2006) [14] found that the significantly highest significantly (p<0.05) concentration of LDL cholesterol observed during summer followed by winter

season in control group. Tak *et al.* (2014) [16] reported that the LDL levels was significantly (p<0.05) highest in mansoon followed by winter seasons in buffalo. Zhao *et al.* (2017) [17] reported that the LDL levels was significantly (p<0.05) highest in summer and lowest during winter seasons in pigs. These findings were in contrast with Kreindl (2014) [9] recorded that the concentration of serum LDL-C were significantly (p<0.05) highest in winter and spring than in summer young adults animals. Moura (2013) [12] significantly (p<0.05) highest LDL-C >130 mg/dl was 8% in winter followed by summer summer. Ohtsuka *et al.* (1992) [13] reported that the LDL concentration was significantly (p<0.05) highest in winter followed by summer in dairy cow.

The mean concentration of very low density lipoproteins was 27.46±0.94, 24.41±0.84 and 28.28±1.00 (mg/dl) in spring, summer and winter seasons, respectively. From statistical analysis, it was found that the concentration of very **l**ow density lipoproteins was significantly (p<0.05) lowest in summer season (24.41±0.84mg/dl) followed by spring season (27.46±0.94 mg/dl) and highest in winter season (28.28±1.00 mg/dl). However, there was no significant difference between spring and winter seasons. This might be due to credited to the corresponding lowest level of triglycerides in crossbred cattle.

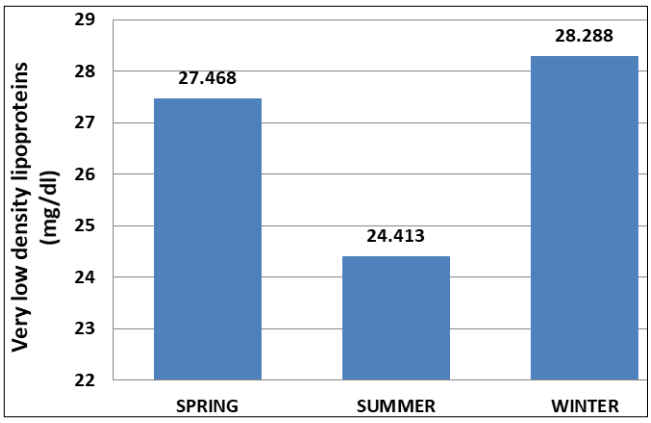

Fig 3: Very low density lipoproteins (mg/dl) in crossbred cattle during different seasons

The finding of the present study was well corroborated with the observation of Gurubasayya and Kalmath (2013) [6] who had also observed the very low density lipoproteins was significant (p<0.05) highest concentration during winter seasons followed by spring and summer seasons in control group might be credited to the corresponding lowest levels of triglycerides in that other group. Ferreira *et al.* (2017) [4] observed the very low density lipoproteins was significant (p<0.05) highest concentration during winter seasons followed by summer seasons in dairy cow might be due to dissimilarity in dietary intake, energy balance and metabolic difficulty. Similar also reported by Garcia *et al.* (2018) [5] in beef cattle and Ferragina *et al.* (2019) [3] very low density lipoproteins was no significant (p<0.05) concentration during winter, summer and spring seasons in beef cattle, respectively. These findings were in contrast with reported by Bhuiyan *et al.* (2017) [1] in indigenous goats VLDL was significant (p<0.05) highest during monsoon seasons followed by winter season.

Conclusions

The present research results showed variation in lipoprotein parameters associated to changes in ambient temperature, and temperature-humidity index, although within the physiological range for crossbred cattle. Therefore, we can claim that the spring, summer and winter variation can manipulate the lipoprotein profile of crossbred cattle. These results provide insights into lipoprotein responses of dairy cattle to raised temperature, allowing bettering evaluating its ability to adapt and cope with environmental stress.

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