The Pharma Innovation Journal 2022; SP-11(10): 2273-2275

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(10): 2273-2275

www.thepharmajournal.com
Received: 06-07-2022
Accepted: 15-09-2022

Mayank Patel
M.V.Sc. Scholar, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

R Huozha
Assistant Professor, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

SK Rastogi
Professor and Head, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

Mrigakshi Yadav
Ph.D. Scholar, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

Abhinaba Maiti
M.V.Sc. Scholar, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

Tanuj Ambwani
Professor, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

Sudhir Kumar
Assistant Professor, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

Corresponding Author:
Mayank Patel
M.V.Sc. Scholar, Department of Veterinary Physiology and Biochemistry, GBPUAT, Pantnagar, Uttarakhand, India

Seasonal influence on milk parameters of indigenous Badri cows

Mayank Patel, R Huozha, SK Rastogi, Mrigakshi Yadav, Abhinaba Maiti, Tanuj Ambwani and Sudhir Kumar

Abstract
Badri is dual purpose indigenous breed of Uttarakhand. The breed is famous for its adaptability to hilly terrains, disease resistance ability and medicinal properties of milk and urine. This study aimed to investigate the influence of seasons on milk parameters of indigenous of Badri cows. Eleven healthy lactating Badri cows were selected randomly from Instructional Dairy Farm of Pantnagar. Meteorological variables (temperature, relative humidity) were recorded and temperature humidity index (THI) was calculated during monsoon, winter and spring seasons by standard formula established by NRC (1971). Milk composition was analyzed using automatic milk analyzer (Ultra Scan Milch Analyzer). Meteorological variables recorded during study period gave higher THI during monsoon (80.62) than winter (58.63) and spring (64.05). The results of the study showed that fat, protein, total solid and SNF were significantly higher during winter as compared to values obtained in monsoon. However, there was non-significant difference observed in lactose, specific gravity, freezing point depression and pH of milk. Thus, it is concluded that higher THI in monsoon season induces more stress on animals that produces adverse effects on milk production and composition.

Keywords: Badri cattle, meteorological variables, milk parameters, season, temperature-humidity index

1. Introduction
India is a tropical country with variety of seasons and weather conditions. Uttarakhand is known for its hot-humid climate during monsoon and intense cold during winter with a short and pleasant spring season. Animals are able to maintain equilibrium between heat production and heat loss under thermoneutral environmental conditions. The thermal comfort zone for most animals is between 4 °C and 25 °C. When the temperature exceeds 25° C animals suffer heat stress. Exposure of animals to heat stress evokes drastic changes in physiological, biochemical and behavioural responses with respect to the animal's genetic make-up and environmental conditions. Milk composition is depending on variety of factors like species, breed, lactation stage, parity, udder health, type of nutrition and season (Haenlein, 2003) [7]. The Badri cattle (Accession number INDIA_CATTLE_2400_BADRI_03040) became the first registered cattle breed of Uttarakhand on 21st June 2016 (ICAR-NBAGR, 2016) [9] which was earlier known as 'Pahadi' cow or 'Hill' cattle. This breed is mainly reared in hilly terrains of Garhwal and Kumaon divisions in Uttarakhand state. The Badri cattle are small sized breed with an adult body weight of 200-250 kg. The breed is famous for its adaptability to hilly terrain, disease resistance ability and medicinal properties of milk, urine and dung. Badri milk has great medicinal properties because they graze on herbs and shrubs which have rich medicinal content. Keeping all these into consideration, the present study was carrying out to explore the seasonal variation in milk parameters of indigenous Badri cattle.

2. Materials and Methods
2.1 Selection of experimental animals and site of the experiment
The present experiment was carried out on eleven healthy lactating Badri cows. The experimental animals were kept in Instructional Dairy Farm (IDF), Pantnagar and the entire laboratory works were carried out at the Department of Veterinary Physiology and Biochemistry, College of Veterinary and Animal Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar-263145. It is located at 244 m above mean sea level (79.49 ºE longitude and 29.3 ºN latitude) in the northern upper Gangetic plains, having an annual rainfall of 1500 mm.

All the experimental animals were maintained in a semi-intensive management system with similar feeding practices. Water was available to the animals according to lactating animal requirement. Prior to the experiment, permission from Institutional Animal Ethical Committee (IAEC) was obtained (IAEC/C.V.A.Sc/VPB/458).

2.2 Recording of meteorological variables

The entire experiment was conducted in 3 seasons *viz*. monsoon season (July 2021-September 2021), winter season (December 2021-January 2022) and spring season (February 2022-March 2022). The daily ambient temperature (AT) and relative humidity (RH) in the farm zone were collated from adjacent Meteorological Centre throughout the study period. The collected data were used to calculate the Temperature-Humidity Index (THI) based on equation of NRC (1971) [14].

$$THI = (1.8\times AT+32) - \{(0.55 - 0.0055\times RH) \times (1.8\times AT - 26)\}$$

Where,
AT = Ambient temperature (°C), RH = Relative humidity (%)

2.3 Milk collection and analysis of milk parameters

Milk samples were collected during evening milking time in each season. Teat dipping before the collection was done with an effective teat dipping solution (0.5% iodine) for 20-30 seconds prior milking. Then, the teats were carefully scrubbed with clean cotton cloth. During collection of milk samples, initial few streaks of milk were discarded and approximately 20 ml of representative milk samples were collected aseptically in sterilized and neatly labelled sampling bottles from all the four quarters of all experimental lactating cows by manual full hand milking technique. Milk samples were transported to laboratory as soon as possible in ice box for analysis. All the milk samples were analyzed within four hours of sampling. Each milk sample was analyzed by Ultra Scan Milch Analyzer machine (Hindustan Thermostatics, Haryana) for Fat %, Solid Not Fat (SNF) %, Protein%, Lactose %, Corrected Lactometer Reading (CLR) and Freezing point depression. Milk pH and electric conductivity were analyzed by digital pH meter (HPG systems, Chandigarh).

2.4 Statistical analysis

The statistical analysis was done with help of one-way ANOVA (for more than two groups of data) using SPSS software package version 22.0. The significant mean differences were separated by Tukey post-hoc analysis with significance level defined at $p<0.05$.

3. Results

3.1 Meteorological Variables

The mean values of meteorological variables recorded during monsoon, winter and spring seasons are shown in Table 1.

Table 1: Meteorological variables recorded during different seasons

Seasons	Meteorological Variables		
	Mean Ambient Temperature (°C)	Relative Humidity (%)	THI
Monsoon	28.33	77	80.62
Winter	14.85	76	58.63
Spring	18.47	70	64.05

The mean values of THI during monsoon, winter and spring seasons were 80.62, 58.63 and 64.05, respectively. THI was higher during monsoon followed by spring and winter.

3.2 Milk Parameters

The mean ±SE values of milk parameters of lactating Badri cattle during different seasons are depicted in Table 2.

Table 2: Mean ±SE values of milk parameters of Badri cattle during different seasons (n=11)

Milk Parameters	Seasons			p-value
	Monsoon	Winter	Spring	
TDMY (kg)	2.33 ±0.18	2.61 ±0.10	2.53 ±0.11	NS
Fat (%)	4.90 ±0.34^{a}	5.92 ±0.26^{b}	5.66 ±0.25^{ab}	0.049
SNF (%)	9.23 ±0.15^{a}	9.82 ±0.11^{b}	9.70 ±0.15^{ab}	0.015
Lactose (%)	5.10 ±0.08	5.41 ±0.04	5.38 ±0.14	NS
Protein (%)	3.36 ±0.06^{a}	3.63 ±0.09^{b}	3.52 ±0.05^{ab}	0.05
TS (%)	14.15 ±0.40^{a}	15.75 ±0.33^{b}	15.37 ±0.35^{ab}	0.012
Specific gravity	1.03	1.03	1.03	NS
Freezing point depression (°C)	0.60 ±0.01	0.64 ±0.01	0.63 ±0.01	NS
pH	6.52 ±0.01	6.56 ±0.03	6.59 ±0.03	NS
Electric conductivity (mS/cm)	4.30 ±0.08^{b}	3.89 ±0.06^{a}	3.99 ±0.09^{a}	0.003

^{a,b} Mean ±SE values with different alphabets in superscript along the row differ significantly ($p\leq0.05$)

The present study revealed that seasonal changes had significant effects on various milk parameters. Milk fat, SNF, protein and total solid percentages were significantly ($p\leq0.05$) higher during winter season as compared to monsoon season but non-significant alterations were recorded with spring season. TDMY was non-significantly elevated during winter season followed by spring and monsoon seasons. Milk electric conductivity was significantly ($p<0.01$) increased during monsoon seasons as compared to winter and spring seasons. Seasonal changes had no significant effects on milk pH and specific gravity. Milk lactose percentage and freezing point depression were non-significantly elevated in winter season than spring and monsoon seasons.

4. Discussion

THI is used to estimate the degree of heat stress in livestock. Habeeb *et al.* (2018) [6] classified THI thresholds for heat stress in cattle as following: comfort (THI < 68), mild discomfort (68 < THI < 72), discomfort (72 < THI < 75), alert (75 < THI < 79) and danger (79 < THI < 84). Therefore, based on this index, animals are in the danger zone during monsoon season while in comfort state during winter and spring seasons. The upper critical air temperature for dairy cattle is between 25 and 26 °C (Berman *et al.*, 1985) [3]. In the present study, air temperature values were much higher than the critical values in monsoon seasons.

In the present investigation, the milk protein of lactating Badri

cattle was significantly lower during monsoon season, which might be due to exposure of cows to heat stress thus increased utilisation of amino acids as an energy source, leading to a reduction in the availability of amino acids for production of milk protein. Our findings are supported by the reports of Baruah *et al.* (2021) [1] and Lim *et al.* (2021) [13] who observed significantly higher milk protein percentage during winter season in cows. Milk fat percentage was significantly higher during winter season as compared to monsoon season. It might be due to decrease in energy intake and increased water intake during the hot and humid climatic conditions of monsoon season may decrease milk fat percentage (Emery, 1978) [4]. Our results are in agreement with the majority of researchers who stated that fat percentage was significantly elevated during winter season (Begum *et al*., 2021 and Kalyan *et al*., 2022) [2, 10].

During monsoon, incidence of udder infection increases leading to release of more Na+ and Cl^- in alveolar lumen because of increased blood capillary permeability, the damage of tight junctions and the destruction of the active ion-pumping systems (Kitchen *et al*., 1980) [11]. The higher Na+ and Cl^- concentration in alveolar secretion during monsoon may increase milk EC (Kitchen, 1981) [12]. According to Forsback *et al*. (2010) [5], milk lactose is least variable component of milk as compared to milk fat, protein and SCC. Our finding agreed with this statement irrespective of different climatic condition. The increase of milk fat and SNF contents during winter may account for increase in total solid percentage of milk. The higher milk freezing point depression values during winter season may be due to increase in milk total solid content and lower water content in milk samples during winter season (Henno *et al*., 2008) [8]. The amplification of bacterial growth and number in the bedding material of housed stock increased during monsoon season due to favourable temperature and humidity which may contribute to the increased bacterial infection rate in monsoon and thereby causing lowering of milk pH.

5. Conclusion

From the present study, it can be concluded that seasonal changes in THI negatively impact milk production and composition in Badri cattle which may affect the livelihood of low and medium scale farmers due to severe economic loss. Therefore, better care and management should be taken during monsoon season to minimize economic losses.

6. Acknowledgements

Authors acknowledged the Director Extension Research and Dean C.V.A.Sc., GBPUAT for all the financial support and assistance in this study.

7. References

1. Baruah U, Kaushik P, Akhtar F, Kalita KB. Effect of season and period of milking on milk constituents of Sahiwal cow in the high humid condition of Assam. Journal of Animal Research. 2021;11(4):725-728.
2. Begum R, Huozha R, Rastogi S, Singh P. Alterations in milk composition due to seasonal and lactational stages in Tarai buffalo. Buffalo Bull. 2021;40(4):637-644.
3. Berman A, Folman Y, Kaim M, Mamen M, Herz Z, Wolfenson D, *et al*. Upper critical temperatures and forced ventilation effects for high-yielding dairy cows in a subtropical climate. Journal of Dairy Science. 1985;68(6):1488-1495.
4. Emery RS. Feeding for increased milk protein. Journal of Dairy Science. 1978;61:825-834.
5. Forsback L, Lindmark-Mansson H, Andren A, Akerstedt M, Andree L, Svennersten-Sjaunja K. Day-to-day variation in milk yield and milk composition at the udder-quarter level. Journal of Dairy Science. 2010;93:3569-3577.
6. Habeeb AA, Gad AE, Atta MA. Temperature-humidity indices as indicators to heat stress of climatic conditions with relation to production and reproduction of farm animals. International Journal of Biotechnology and Recent Advances. 2018;1(1):35-50.
7. Haenlein G. Nutritional value of dairy products of ewe and goat milk. Journal of Dairy Science. 2003;69:32-37.
8. Henno M, Ots M, Joudu I, Kaart T, Kart O. Factors affecting the freezing point stability of milk from individual cows. International Dairy Journal. 2008;18:210-215.
9. ICAR-NBGAR (Indian Council of Animal Genetic Resources-National Bureau of Animal Genetic Resources). Hisar, India. Report: ICAR-NBAGR Newsletter, Animal Genetic Resources of India. 2016;13(1):2.
10. Kalyan UPV, Vasantha SKI, Tej JNK. Effect of seasonal variation in temperature humidity index on milk production and its composition in Murrah buffaloes. Journal of Veterinary and Animal Science. 2022;53(1):89-93.
11. Kitchen BJ, Middleton G, Durward IG, Andrews RJ Salmon MC. Mastitis diagnostic tests to estimate mammary gland epithelial cell damage. Journal of Dairy Science. 1980;63(6):978-983.
12. Kitchen BJ. Review of the progress of dairy science: bovine mastitis: milk compositional changes and related diagnostic tests. Journal of Dairy Research. 1981;48:167-188.
13. Lim DH, Mayakrishnan V, Ki KS, Kim Y, Kim TI. The effect of seasonal thermal stress on milk production and milk compositions of Korean Holstein and Jersey cows. Animal Bioscience. 2021;34(4):567-574.
14. National Research Council. A Guide to Environmental Research on Animals. National Academy of Sciences, Washington, DC; c1971. p. 374.