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Compositional quality of milk of Murrah Buffaloes in rural area

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Abstract
The objective of present investigation was to evaluate the effect of hot climate of summer season on major compositional parameters of Murrah buffaloes. Raw buffalo milk samples from the rural area were collected fortnightly during winter (November- January); thermoneutral (February- March) and summer (April- June) season. Significant (p<0.05) decrease in fat content (8.35% to 7.57%, winter to summer) was observed during the summer season. Milk protein content (from 3.55% to 3.25%) was also observed to be decreased significantly (p<0.05) due to the summer stress. SNF content decreased significantly (p<0.05) from 9.90 to 9.22% from winter to summer season. During thermoneutral zone composition is alike to winter season. Conversely ash and lactose content did not change significantly (p>0.05) during different climatic conditions. Results indicated that summer season has a depressing effect on milk major compositional parameters.

Keywords: milk composition, summer season, rural area

Introduction
The milk composition has a significant effect on the chemical as well as nutritional quality of the milk and milk products [1]. Therefore it is essential to investigate the factor affecting the milk composition which might influence the milk quality. The chemical composition of milk varies with the stage of lactation, individuality of the animal, feed, season and health status of the animal and also varies with the milking frequency [2]. Therefore any fluctuation in the milk composition can be avoided via management of feeding practices and also with the nutritional supplementation. Among all the factors, the genetic factor has a major impact on the milk composition [9, 10]. But genetic manipulation is a most difficult task to change the milk production. Several researchers have examined the impact of seasonal variability on the compositional quality [20]. Change in the season affects the milk composition via affecting the diet pattern [2]. Different countries have different feeding management and climatic conditions [11]. Several studies have assessed the correlation among the major milk components and other indices which are related to the health of animal. High somatic cell counts cause the poor coagulating property which directly reduce the milk quality and flavour [12]. Therefore, the correlation among the seasonal change and composition of milk in India are worth exploring. Apart, study on compositional quality assessment of raw milk of rural area is lacking. Hence the objective of the present study was to assess the seasonal variation effect on the milk composition of Murrah buffaloes of rural area during mid lactation period. The idea related to the seasonal changes in the milk composition of the Murrah buffaloes could provide a better way-out to guide the common man in rural area regarding the management of animals under stressed conditions.

Material and Methods
Milk samples from Murrah Buffaloes were collected from the common households of nearby village of Karnal area during the winter (November to January), summer (April to June) and thermoneutral zone (Feb. - March). Four lactating animals of Mid - lactation period were selected from villages of Karnal area.

Management of Buffaloes
Buffaloes of Mid lactation period were housed in the loose housing system. Seasonal ration was given to the animals. Milk samples were withdrawn fortnightly and assessed for the compositional analysis.

Compositional analysis
Approximately 250 ml of milk samples were collected in clean plastic bottles during morning and evening. Then the samples were pooled and assessed for Fat, SNF, protein, lactose and ash content.

Determination of major compositional parameters
Fat content was measured as per the method explained in IS: 1224 (Part-1), 1977 (Reaffirmed 2012). SNF content was determined according to IS: 10083, 1982 (Reaffirmed, 2013) method. Protein content was determined using the method ISO 8968-11; 2014. Lactose content in milk was determined by Lane and Eynon method as outlined in NDRI laboratory manual on carbohydrate, minerals and water soluble vitamins.

Statistical analysis
Data was analysed using ANOVA in MS-Excel at 5% level of significance. Data presented as mean ± SE.

Results and Discussion
Milk compositional parameters
Changes in fat content
The fat content in Murrah buffaloes of Mid lactation period during different seasons winter, thermo neutral and summer seasons was estimated and presented in Table 1. The results predicted that the% fat content of Murrah Buffaloes was observed to be higher in winter and thermo neutral season than the summer season. The decreased in the% Fat content in the summer season could be the consequence of change in the diet pattern as well as environmental stress. The% fat variability can be linked with the milk yield, as milk yield has an inverse relation with the% fat.
Decrease in the fat content during the summer season might be due to the increased dry feed intake which might contribute to reduce energy intake. Heat stress also reduces the saliva production which affects the rumen buffering capacity. Decrease in the rumen pH also results in the decrease in the fat content in milk. Higher milk fat content during the winter season might be due to lesser water intake [18].

Changes in solid not fat content
Solid not fat followed the similar trend as that of Fat content in Murrah Buffaloes during different seasons (Table 1). This indicated that the summer season depresses the Fat and SNF content. There is an increase in the fat and SNF content during the winter or colder season.
Climatic conditions play an important role to affect the milk composition. It has been observed that high light to dark ratio also affect the milk composition as consequences of greater secretion of prolactin whose concentration observed to be higher in the summer than in the winter which results in the more dilution of the milk [13].

Changes in protein content
Similar to the fat and SNF content, the protein content of buffaloes during different seasons also observed to be decreased during summer season (Table 1). Results also showed that the heat affected the protein content equally as that of the fat and SNF content. However in winter and thermoneutral season the protein content remained the same.

Changes in the lactose and ash content
No significant ($p>0.05$) difference in the ash and lactose content content was observed during the different seasons in the Murrah buffaloes (Table 1). This indicated that seasons did not affect the lactose and ash content.
Our results in the present study are in accordance with the results observed by McDonalds *et al*., 1988 and Mihaiu *et al*., 2010, who reported a non significant difference in the lactose content because during hot weather body fat reserve undergoes chemical breakdown and maintain the glucose level in normal range in the animal blood and maintained energy which in turn maintain the milk carbohydrate supply.

Table 1: Compositional parameters of Murrah buffaloes under different climatic conditions

Changes in Fat Content (%)			
Murrah Buffaloes	**Winter (December - January)**	**Thermo neutral (February – March)**	**Summer (April-June)**
1	8.4 ± 0.05	8. 8 ± 0.01	7.9 ± 0.08
2	8.2 ± 0.01	8.5 ± 0.02	7.1 ± 0.06
3	8.5 ± 0.08	8.4 ± 0.05	7.2 ± 0.03
4	8.3 ± 0.02	8.5 ± 0.03	8.1 ± 0.009
Average	**8.35 ± 0.04**	**8.55 ± 0.02**	**7.57 ± 0.04**
Changes in Solid Not Fat Content (%)			
1	9.92 ± 0.05	9.88± 0.03	9.44± 0.05
2	9.85± 0.02	9.71± 0.01	9.24± 0.03
3	9.99± 0.05	9.81±0.03	9.09± 0.01
4	9.87± 0.02	9.69± 0.09	9.11± 0.02
Average	**9.90 ± 0.03**	**9.77 ± 0.04**	**9.22 ± 0.02**
Changes in Protein Content (%)			
1	3.55 ± 0.02	3.48 ± 0.01	3.24 ± 0.01
2	3.61 ± 0.04	3.59 ±0.01	3.33 ±0.02
3	3.54 ± 0.08	3.52 ± 0.02	3.28 ±0.01
4	3.52 ± 0.04	3.51 ± 0.02	3.18 ± 0.02
Average	**3.55 ± 0.04**	**3.52 ± 0.01**	**3.25 ± 0.015**
Changes in Lactose Content (%)			
1	5.22 ± 0.22	5.18 ± 0.23	5.16 ± 0.16
2	5.08 ± 0.21	5.11 ± 0.22	5.14 ± 0.14
3	5.12 ± 0.13	5.14 ± 0.19	5.12 ± 0.12
4	5.33 ± 0.18	5.24 ± 0.16	5.09 ± 0.18
Average	**5.18 ± 0.18**	**5.16 ± 0.2**	**5.12 ± 0.15**
Changes in Ash Content (%)			

1	0.82 ± 0.02	0.84 ± 0.04	0.82 ± 0.04
2	0.88 ± 0.04	0.86 ± 0.02	0.84 ± 0.03
3	0.79 ± 0.03	0.84 ± 0.06	0.81 ± 0.02
4	0.86 ± 0.04	0.85 ± 0.08	0.83 ± 0.01
Average	0.83 ± 0.03	0.84 ± 0.05	0.82 ± 0.02

Mean ± SE; n= 3

Conclusion

The change in the season have affected the milk composition like Fat, SNF, protein content as observed in the current investigation. Summer season showed the depressing effect on the composition of the milk. Hence this seasonal stress can be managed via supplementation of nutritional feed and also by modifying the in house management practices.

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