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Effect Of Management Practices On Milk Yield And Composition Of Lactating Murrah Buffaloes During Different Seasons

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ABSTRACT
The present investigation was carried out to determine the effect of management practices on milk yield and composition of lactating Murrah buffaloes during different seasons. Seasonal experiment was carried out during hot-dry, hot-humid and winter season. Buffaloes were divided into control and treatment groups. In hot-dry and hot-humid season, treatment group animals accessed benefit of mist and fan cooling, control group animals were devoid of it. In winter, treatment group animals were placed in- house with floor bedding of paddy straw; control group animals were placed in loose housing system without bedding.During hot-dry season, cooling system significantly increased (p<0.05) milk yield, milk protein, without affecting milk fat, lactose, SNF, calcium. During hot-humid, cooling system significantly increased (p<0.05) milk yield but there was no effect of treatment on milk composition. During winter, in-house management with paddy straw bedding improved milk yield significantly (p<0.05); however no effect of treatment was observed on milk composition. It was concluded that provision of mist and fan in summer and in-house management of buffaloes during winter season is helpful in improvement of milk production by alleviating seasonal stress.
Key words: *Milk yield, milk composition, Murrah buffalo and season.*

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INTRODUCTION

Milk has long been recognized as a valuable food of pastoralist diets in all the world, also it is a nutrient food and is recognized to contribute a high proportion of the nutrients, (1). Different factors, such as race of animals, genetic variants, stage of lactation and environmental factors can significantly affect on milk component and properties of milk (2). Between the environmental factors, the feeding of animals and season of the year has a considerable influence on milk components and properties. This seasonal variation confirms that milk properties such as taste, color, fat content and even kinds of fats differ by season. However, seasonal effect on dairy animals can be managed using different approaches such as cooling, shading. Therefore, there is an urgent need for the study of effect of change of the external macro-environment into an acceptable micro environment for more production of milk. Keeping the above points in view, the present research work was planned to assess the impact of management system on milk yield and composition of Murrah buffaloes during different seasons.

MATERIALS AND METHODS

Selection and management of animals

The experiment was carried out on twelve lactating Murrah buffaloes (6 treatment and 6 control) in II or III parity with average 5kg/day milk yield, selected from the livestock herd of National Dairy Research Institute, Karnal during three seasons *i.e.*hot dry,hot humid and winter seasons. The average stage of lactation (SOL) of these animals was 150 ±10 days. The buffaloes under treatment group were provided mist and fan facility from 9:30am to 5:00pm during summer season (hot dry and hot humid season) while control group buffaloes were maintained as such without mist and fan. During winter season the treatment group buffaloes were provided in-house shelter with paddy straw bedding, while control group were kept in loose housing system. All the lactating Murrah buffaloes were fed on a ration consisting of roughages (berseem, oats, maize or jowar fodder) as per the availability in the farm. The concentrate mixture consisted of mustard cake, wheat bran, rice bran, mineral mixture and common salt, was offered individually to each buffalo at 8.30 AM @ 1 kg per 2.0 kg of milk production during morning and evening milking. Fresh tap water was available for drinking to all the animals round the clock.

Collection of milk samples

Milk samples from experimental buffaloes were collected twice a day (6 a.m. and 6 p.m.) at weekly intervals. Milk samples were brought to the laboratory soon after collection and analyzed for fat, protein, lactose and SNF using Lacto Scan- automatic milk analyzer (Mega netoo, Bulgaria). About 10 ml of milk sample from individual animal of each milking was collected in a properly cleaned milk sample bottle and pre-warmed at 39-40ºC before analysis. Ca in milk was estimated by using atomic absorption spectrophotometer (Model Z-5000, Polarized Zeeman Atomic absorption Spectrophotometer, Hitachi High-Technologies Corporation, Tokyo, Japan).

Statistical analysis

Data were analysed by general linear model procedure (SPSS version 20.0, 2011, IBM Corporation, Armonk, NY, USA) using repeated measures ANOVA with repeated measures over time and the buffalo as experimental unit. The data generated has been presented as mean with SEM. Overall differences between treatment means were considered significant when $P<0.05$.

RESULTS AND DISCUSSION

Milk yield

Mean milk yield (kg/day) in control and treatment group of Murrah buffaloes during hot dry, hot humid and winter season have been presented in Table no 1. Milk yield was significantly ($p<0.05$) higher in treatment group as compared to control group in all seasons reflecting that mist and fan cooling during summer and in-house shelter management with paddy straw bedding was helpful in alleviating the environmental stress and helped in restoring milk production; milk yield was statistically similar between control and treatment group during hot humid and winter season. While comparing between the seasons, it was noticed that milk yield was significantly ($p<0.05$) higher during hot dry season as compared to hot humid and winter season in both treatment and control group. The present findings of decline in milk yield during heat stress are in collaboration with previous findings in cows (3, 4). When animals are subjected to heat stress, feed intake decreases. Simultaneously, maintenance requirements are increased due to activation of the thermoregulatory system. There is need to expend energy to maintain homeothermy that would otherwise be available for useful production (5). Provision of mist and fan cooling is beneficial during heat stress to restore the capability and results in increased milk yield.

Milk fat

Mean milk fat (%) in control and treatment group of Murrah buffaloes during hot dry, hot humid and winter season have been presented in Table no 1. Milk fat level was significantly ($p<0.05$) higher in winter as compared to hot dry in control group. In treatment group, hot dry and hot humid season milk fat level varied non-significantly while the other groups are varied significantly among others. Lower level of milk components during hot weather and high humidity may be due to decreased dry matter intake and consequently energy intake, which in turn can reduce. Heat stress is also known to decrease saliva production, which in turn can affect the buffering capacity of the rumen. Reduced ruminal pH may reduce milk fat. Higher milk fat content during winter may be due to reduced water intake during the cold season and increased fat concentration was also recorded by other researchers (6).

Milk protein

Mean milk protein (%) in control and treatment group of Murrah buffaloes during hot dry, hot humid and winter season have been presented in Table no 1. Milk protein level was higher in treatment group during hot dry season but no effect of treatment was reflected on milk protein level during hot humid and winter season While season is taken into consideration, it was noted that milk protein level was significantly ($p<0.05$) different among all the three seasons in control group, with highest value (4.17%) observed in winter and lowest (3.82%) in hot dry season. In treatment group, it was observed that milk protein level significantly ($p<0.05$) differed among in hot dry and winter; hot dry and hot humid season, though winter and hot humid value varied non significantly. In general, protein concentrations during the dry season are higher than in the summer time (rainy season) (7). Differences between the seasonality effects on milk composition may be associated with reduced quality and availability of feed provided to animals during dry periods that limit energy supply to the mammary tissue epithelium, and thus, mammary secretion of milk components (8). The low ambient temperature during the cold season elevated the milk production and protein percentage of milk as expected and recorded by other researchers (9).

Milk lactose

Mean milk lactose (%) in control and treatment group of Murrah buffaloes during hot dry, hot humid and winter season have been presented in Table no 2. The mean milk lactose (%) did not varied during hot dry, hot humid and winter season, respectively. Treatment effect was thus not observed in these seasons. However, season had influence on milk lactose concentration. In both control and treatment groups, it was observed that milk lactose was significantly ($p<0.05$) higher in winter season as compared to hot dry and hot humid season.

Milk SNF

Mean milk SNF (%) in control and treatment group of Murrah buffaloes during hot dry, hot humid and winter season have been presented in Table no 2. It was noticed that management practices had no significant effect on milk SNF level but seasonal effect was there on this parameter. Milk SNF was significantly ($p<0.05$) higher during winter season as compared to hot dry and hot humid seasons in the both groups.

Milk calcium

Mean milk calcium (mg/dl) in control and treatment group of Murrah buffaloes during hot dry, hot humid and winter season have been presented in Table no 2. The mean milk calcium (mg/dl) was not affected by fan and mist cooling in summer, however, in house shelter management in winter increased milk calcium level. Further, milk calcium level was significantly ($p<0.05$) higher during winter season as compared to hot dry and hot humid season in treatment group buffaloes. A marked reduction in plasma Ca levels were found in ewes exposed to high ambient temperature and was suggested that the parathyroid hormone may be involved in this mechanism (10). A general reduction of the mineral content in cow summer milk probably may be due to a decrease in osmotic pressure in the mammary gland under hot climates (11).

Table 1.Mean (±SE) milk yield (kg/day), fat and protein (%) in control and treatment group of lactating Murrah buffaloes during different seasons

		Week of experiment						**Overall**
Season		**I**	**II**	**III**	**IV**	**V**	**VI**	**mean**
Milk yield (kg/day)								
Hot dry	**Control**	6.63±0.08	6.33±0.00	5.94±0.09	5.36±0.16	5.31±0.14	5.57±0.03	**5.86**^{x}±0.22
	Treatment	6.33±0.00	6.33±0.00	6.33±0.00	6.15±0.07	5.90±0.03	5.65±0.04	**6.12**^{y}±0.12
Hot humid	**Control**	4.01^{a}±0.15	4.73^{b}±0.19	5.02^{bc}±0.15	5.31^{c}±0.12	5.83^{cd}±0.13	5.97^{d}±0.04	**5.15**^{x}±0.30
	Treatment	4.17^{a}±0.16	4.85^{b}±0.18	5.69^{c}±0.19	6.27^{d}±0.24	7.13^{e}±0.07	7.30^{e}±0.03	**5.90**^{y}±0.51
Winter	**Control**	6.20±0.07	5.63±0.16	5.55±0.05	4.98±0.15	4.93±0.18	4.74±0.10	**5.34**^{x}**±**0.23
	Treatment	6.28±0.06	6.05±0.08	5.89±0.09	5.71±0.12	5.67±0.14	5.63±0.14	**5.87**^{y}±0.10
Milk fat (%)								
Hot dry	**Control**	7.72±0.38	8.10±0.38	8.01±0.43	8.48±0.43	7.87±0.67	7.91±0.42	**8.01**±0.18
	Treatment	7.65±0.35	8.21±0.58	8.68±0.41	7.93±0.34	8.36±0.37	8.18±0.35	**8.17**±0.17
Hot humid	**Control**	8.42±0.38	8.50±0.41	8.35±0.36	8.49±0.37	8.30±0.32	8.45±0.34	**8.42**±0.14
	Treatment	8.65±0.33	8.62±0.26	8.43±0.25	8.58±0.25	8.61±0.19	8.50±0.18	**8.56**±0.10
Winter	**Control**	8.74±0.27	8.67±0.28	9.02±0.27	9.00±0.31	8.72±0.28	8.98±0.40	**8.86**±0.12
	Treatment	8.96±0.53	8.90±0.37	8.86±0.44	9.25±0.33	9.20±0.40	9.21±0.32	**9.06**±0.16
Milk protein (%)								
Hot dry	**Control**	3.84±0.08	3.77±0.10	3.85±0.12	3.82±0.11	3.82±0.16	3.84±0.14	**3.82**^{x}**±**0.05
	Treatment	3.89±0.11	3.84±0.09	3.88±0.10	3.86±0.06	3.94±0.10	3.96±0.12	**3.89**^{y}**±**0.04
Hot humid	**Control**	3.92±0.07	3.94±0.11	4.03±0.21	3.97±0.08	3.99±0.07	4.06±0.10	**3.98**^{x}**±**0.05
	Treatment	4.07±0.14	4.08±0.10	4.10±0.11	4.04±0.11	4.08±0.14	4.17±0.11	**4.09**^{x}**±**0.05
Winter	**Control**	4.23±0.13	4.21±0.15	4.17±0.10	4.18±0.12	4.11±0.10	4.13±0.09	**4.17**^{x}**±**0.05
	Treatment	4.21±0.12	4.05±0.09	4.11±0.12	4.23±0.11	4.27±0.12	4.21±0.13	**4.18**^{x}**±**0.05

Values with different superscript in column $^{(x, y)}$ varied ($p<0.05$)

CONCLUSION

Climatic conditions and seasonal variation can play an important role on alteration in milk composition. The major components of milk (fat, protein, lactose, SNF and calcium) were found to be affected by seasonal changes in our present study. These important milk constituents were found to be higher in winter but lower in summer. Provision of improved management system in form of mist and fan in summer and in-house management of buffaloes during winter season was found to be effective to enhance milk production performance. However, management practices had no significant effect in milk composition.

Table 2.Mean (±SE) milk lactose, SNF (%) and calcium concentration (mg/dl) in control and treatment group of lactating Murrah buffaloes during different seasons

Season		Weekof experiment						Overall mean
		I	II	III	IV	V	VI	
Milk lactose (%)								
Hot dry	**Control**	4.82±0.08	4.79±0.08	4.78±0.07	4.74±0.11	4.79±0.11	4.83±0.08	**4.79**±0.04
	Treatment	4.88±0.09	4.84±0.07	4.89±0.07	4.87±0.09	4.91±0.08	4.85±0.12	**4.87**±0.03
Hot humid	**Control**	4.82±0.07	4.87±0.07	4.90±0.08	4.92±0.11	4.91±0.08	4.84±0.05	**4.88**±0.03
	Treatment	4.91±0.07	4.89±0.09	4.90±0.08	4.98±0.10	5.03±0.10	4.92±0.06	**4.94**±0.03
Winter	**Control**	5.05±0.06	4.98±0.09	5.08±0.06	5.10±0.08	5.12±0.07	5.06±0.05	**5.07**±0.03
	Treatment	5.02±0.08	5.10±0.07	5.08±0.09	5.18±0.08	5.19±0.07	5.20±0.06	**5.13**±0.03
Milk SNF (%)								
Hot dry	**Control**	9.91±0.13	9.86±0.10	9.87±0.10	9.78±0.12	9.92±0.09	9.90±0.11	**9.87**±0.04
	Treatment	10.00±0.09	9.93±0.08	10.04±0.07	9.91±0.10	9.95±0.10	10.05±0.12	**9.98**±0.04
Hot humid	**Control**	10.03±0.10	9.95±0.11	9.96±0.12	9.95±0.15	9.94±0.06	9.90±0.10	**9.96**±0.04
	Treatment	9.99±0.10	9.93±0.10	10.02±0.11	10.06±0.15	10.11±0.17	10.10±0.15	**10.03**±0.05
Winter	**Control**	10.11±0.11	9.99±0.15	10.04±0.12	10.09±0.17	10.03±0.14	10.02±0.09	**10.05**±0.05
	Treatment	10.10±0.11	10.04±0.10	10.10±0.11	10.21±0.14	10.26±0.11	10.28±0.15	**10.16**±0.05
Milk Calcium (mg/dl)								
Hot dry	**Control**	182.68±13.15	179.45±14.29	181.55±8.31	185.27±10.81	178.90±12.76	183.43±11.11	**181.88**^{x}±4.51
	Treatment	186.87±18.93	189.92±11.29	193.48±13.18	200.30±11.75	198.70±14.76	194.70±15.80	**193.99**^{x}±5.54
Hot humid	**Control**	193.85±8.83	191.23±17.56	189.33±8.27	197.21±9.21	190.75±9.85	193.11±12.85	**192.58**^{x}±4.39
	Treatment	190.52±12.99	198.46±14.07	197.95±10.17	206.47±9.95	196.32±16.76	208.29±15.06	**199.67**^{x}±5.17
Winter	**Control**	209.58±13.75	203.09±15.40	213.52±7.01	204.89±16.46	200.87±9.44	206.27±7.27	**206.37**^{x}±4.65
	Treatment	209.14±11.33	217.57±16.14	219.58±12.98	222.99±13.64	229.38±14.92	228.97±11.14	**221.27**^{y}±5.23

Values with different superscript in column $^{(x, y)}$ varied ($p<0.05$)

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