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Shortened dry period in dairy Buffaloes: Influence on milk yield, milk components and reproductive performance

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ABSTRACT

The objective of the present study was to determine the effect of the duration of the dry period (DP) on milk yield, milk composition, and reproductive performance of Murrah buffaloes in the subsequent lactation. High yielding Murrah buffaloes (n=48) were assigned to either shortened (30 to 45 d (n=16); and 45 to 60 d (n=16)) or traditional (>60 days (n=16)) dry period lengths. The buffaloes were fed individually according to the production status. The buffaloes in >60, 45 and 30 d dry period groups had similar (P>0.05) milk yield, 6% Fat corrected milk (FCM), milk fat, and total solids; however, the former groups had an increased (P<0.05) 6% FCM yield change, and SNF percentage of milk. The mean service period (days) was least (P<0.05) with the higher number of services required for conception in buffaloes allocated to traditional dry period length compared to those assigned to shortened dry periods. Further, 6% FCM had a negative correlation with Serum Glucose (SG) values at 30 d postpartum, followed by a significant positive (P<0.01) correlation at 60 or 90 d postpartum. It is concluded that extended DP of more than 60 days is not advantageous and would be a costly affair for the farmers in both productive and reproductive backdrop.

Key words: Milk composition, Milk yield, Murrah buffaloes, Reproductive performance, Shortened dry period.

INTRODUCTION

Dairy is a vital part of the global food system and it plays a key role in the sustainability of rural areas in particular. Maintaining a higher milk production is always a very important objective for the dairy farmer. Optimum milk yield and composition are influenced by many factors including, but not limited to, feeding, health status of the breed, genetic variation within the breed, parity, age and length of the dry period (DP) in the preceding lactation. The DP can be considered as a directly observed economic trait of practical significance in dairy farming. A well established DP is required to allow proper involution of the mammary gland epithelium to maximize milk yield during the subsequent lactation. Complete omission or shortening of DP decreases milk production following parturition (Madsen *et al*., 2008). However, several researchers noticed improved milk production in cows either with short (Pezeshki *et al.*, 2008) or completely omitted dry periods (Andersen *et al*., 2005). Due to the ambiguity in the dry period allotment, the optimum dry period length is one of the most studied concepts in dairy management.

A total 57% of the world’s buffalo population resides in India, and it was hypothesized that Indian coastal region is dominated by buffaloes over other livestock species, as they are more able to tolerate high humid climatic condition characterizing the region (Raju *et al*., 2017). Considering the importance of buffalo rearing in Indian rural livestock sector, a work was conducted in high yielding Murrah buffaloes to determine the effect of shortening the dry period (DP) on the milk yield, milk composition and service period in the subsequent lactation.

MATERIALS AND METHODS

Forty-eight multiparous Murrah buffaloes in dry periods were selected from organized private buffalo farms in Veeravalli region, Krishna district, Andhra Pradesh state, and assigned to a completely randomized design with three dry period lengths *viz.* more than 60 d (n=16); 46 to 60 d (n=16); and 30 to 45 d (n=16). They were blocked by parity, previous 305 day milk yield, and the expected dates of calving. The buffaloes were fed *adlibitum* hybrid Napier and 4 kg paddy straw as a roughage source. The concentrate mixture prepared by using locally available ingredients (i.e., maize, DORB, soybean meal, sunflower cake, urea, mineral mixture and salt @ 33.25, 34, 18.75, 10, 1, 2, and 1 percent, respectively) was fed to the buffaloes individually, based on the production ability of each buffalo (One kg CM for 2 lts

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milk production, and 1.5 kg CM as an allowance for fetus growth during 30 days prepartum).

Proximate analysis was done as per the AOAC (2007), and forage fiber fractions according to Vansoest *et al*. (1991). The milk samples were collected from the individual animal at every fortnightly interval after calving up to 90 days postpartum, into a sterile bottle for the estimation of milk components (Fat, SNF and Total Solids). The milk fat was determined by Gerber's method (ISI 1977 IS: 1224 part – 1) using special butyrometer and pipette with ISI marking. The SNF was calculated using the gravimetric method (ISI 1982 IS: 10083) based on estimation of specific gravity using corrected lactometer reading (CLR). Lactometer standardized at 20^0C was used according to the temperature of milk in Fahrenheit using ISI chart.

SNF % = CLR/4 + 0.25 F +0.6

Where, CLR = Corrected Lactometer reading and F = Fat percent

The total solids content of the milk was arrived by the addition of Fat and SNF percentages.

From the milk yield and fat yield of animals, 6% FCM was calculated using the method of Rice *et al*. (1970) using the following formula;

6% FCM = 0.308 x Total Milk Yield +11.54 x Total Fat Yield (kg)

Blood samples were collected in plain and sterile test tubes from the jugular vein at the time of 30, 60 and 90 days postpartum and the SG levels were estimated, for correlation studies, by using Erba Mannheim Glucose kits (Trinder's method, Endpoint Assay) by assay procedure. Teaser bull was used for detecting silent heat to obtain flawless data and eventually inseminated through artificial insemination (AI) technique. Date of ovulation and number of inseminations required for conception were recorded along with the date of successful conception.

Statistical analysis: The estimated data of total milk yield, 6% FCM, Milk Fat, SNF, Total Solid levels and Service period (days) were subjected to ANOVA (Snedecor and Cochran, 1994) using software package SPSS version 17.0, and differences in mean were assessed by using Duncan's multiple range test (Duncan, 1955). Data were analyzed for statistical correlation (2 tailed test of significance) of SG and 6% FCM at 30, 60 and 90 d postpartum using Pearson coefficient.

RESULTS AND DISCUSSION

Buffaloes used in this study were kept under identical environmental conditions and were fed the same diets after calving, depending upon the production status. The estimated percentages of CP, EE, CF, and NDF were 6.23, 1.84, 23.11, and 69.09; 3.54, 1.65, 42.58, and 69.80; and 21.3, 9.14, 5.98, and 14.88 in Hybrid Napier, Paddy Straw, and CM, respectively.

Total milk yield and 6% FCMY changes: Average milk yield and 6% FCMY changes of the buffaloes allotted to three groups are presented in Table 1. Milk yield increased during the first 8 weeks of lactation, regardless of the treatments. Subsequently, buffaloes reached a peak milk yield at 60 days postpartum, followed by a gradual decline in milk production (Fig. 1). The effect of the postpartum period was significant (P<0.01) on the milk yield among the three treatments. The average MY and 6% FCM were similar among the three groups (P>0.05), revealing that a thirty day dry period may be adequate for dairy animals as the mammary involution and tissue proliferation in dairy cows can be completed by the 25th day of the dry period (Capuco *et al*., 1997). Further, increased 6% FCMY changes were significantly higher (P<0.05) in group III and II compared to the group I, from calving to 60 days postpartum period. The same trend continued even after 60 days postpartum with lowered (P<0.05) negative 6% FCMY changes in group III and II compared to the first group. In shortened dry period cases, the animals prepartum are generally fed high energy concentrate diets to meet the milk production demand, thereby maintaining a continuous adaptability for rumen microbes to the concentrate feed (Reddy *et al*., 2016), and

Table 1: Influence of dry period groups on average milk yield and 6% FCMY changes of the buffaloes.

Period	Component	GROUP I	GROUP II	GROUP III	SEM
Calving to15 days	Milk yield (kg)	12.12	10.51	9.18	0.19
	6% FCMY (kg) changes	-	-	-	-
16 to 30 days	Milk yield (kg)	14.60	13.66	12.47	0.24
	6% FCMY (kg) changes	2.87^a (+)	3.65^b (+)	3.96^c (+)	0.10
31 to 45 days	Milk yield (kg)	16.16	16.26	15.62	0.24
	6% FCMY (kg) changes	2.07^a (+)	3.43^b (+)	4.04^c (+)	0.09
46 to 60 days	Milk yield (kg)	18.70	20.63	19.95	0.26
	6% FCMY (kg) changes	3.27^a (+)	5.62^b (+)	5.90^c (+)	0.83
61 to75 days	Milk yield (kg)	16.70	19.14	18.86	0.22
	6% FCMY (kg) changes	1.57^a (-)	0.99^b (-)	0.63^c (-)	0.08
76 to 90 days	Milk yield (kg)	15.31	17.44	17.49	0.19
	6% FCMY (kg) changes	1.1^a (-)	1.32^b (-)	0.94^c (-)	0.06

^{abc}Values in the rows bearing different superscripts differ significantly (*P<0.05)

'+' Increased '-' Decreased

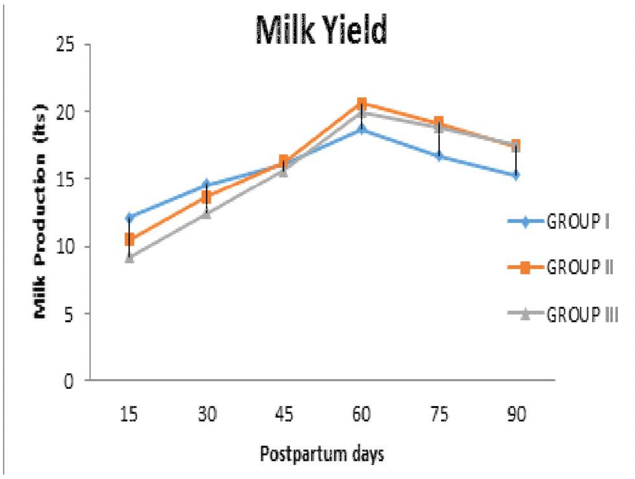

Fig 1: Effect of various dry period lengths on milk yield of Murrah Buffaloes.

so, they can successfully utilize the high energy diets fed immediately after calving. Often, dietary switches in ruminant nutrition may lead to decreased energy balance and increased risk of metabolic disorders (Khazanehei *et al.*, 2015), thus decreasing the 6% FCM changes. Shortened dry period improves the energy balance in early lactation due to the decreased nutritional stress of diet change, easing of transition to lactation, and reduced risk of metabolic disorders (Pezeshki *et al.*, 2008) as evident from the positively attributed 6% FCMY changes in group II and III. Another added benefit of the shortened dry period includes improved mammary gland health, as high milk yield before the cessation of milking or drying off increases susceptibility to mastitis (Newman *et al.*, 2010).

Several researchers observed improved milk yield in cows with short (Pezeshki *et al.*, 2008) or completely omitted dry periods (Andersen *et al.*, 2005) in dairy cows. On the contrary, Atashi *et al*. (2013) reported a lowered milk yield and 6% FCM in the animals allotted to dry period of 30 d and compared with 51 to 60-days. However, this scenario did not reflect in the present case, as beneficial effects of the shortened dry period are predominant in high yielding animals (Soleimani *et al.*, 2010); and high- yielding Murrah buffaloes with a peak average production potential of 20 liters per day were used in the current study.

Milk components: Influence of dry period groups on Milk Fat, Milk SNF and total solids of Murrah buffaloes is presented in Table 2. Although nonsignificant (P>0.05), an increased milk fat percent was seen in shortened dry period, compared to traditional dry period lengths (Fig. 2). Similarly, Santschi *et al.*, (2011) reported a non-significant increase in milk fat percentage in dairy cows allotted to the shortened or completely omitted dry periods. Early lactation cows have a tendency to mobilize body reserves while ingesting rations that are low in effective fiber that will tend to decrease milk fat levels (Eicher, 2004) during initial days of lactation, as noticed in the present study.

The mean SNF percent showed an increased (P<0.01) trend from calving to 90 days postpartum. However, a lowered milk SNF percent (P<0.05) was noticed in group I compared to the other two groups (Fig. 3). Similarly, Santschi *et al.* (2011) reported improved milk protein concentration on shortening the dry period. This phenomenon might be due to better energy balance as shown by a reduced incidence of ketosis in early lactation following a short dry period (Pezeshki *et al.*, 2008). In addition, fewer diet changes in the transition period might be associated with higher microbial protein synthesis, which could, in turn, favor the milk protein synthesis (Santschi and Lefebvre, 2014).

The shortened dry period did not show any negative effect on the total solids percentage. Indeed, a nonsignificant

Table 2: Influence of dry period groups on Milk Fat, Milk SNF and total solids of Murrah buffaloes.

Period	Milk Component	Group I	Group II	Group III	SEM
Calving to15 days	Milk Fat (%)	6.63	6.77	6.33	0.03
	Milk SNF (%)	8.88^a	8.99^b	9.07^b	0.02
	Total Solids (%)	15.51	15.76	15.40	0.04
16 to 30 days	Milk Fat (%)	6.72	6.87	6.71	0.03
	Milk SNF (%)	8.98^a	9.11^b	9.17^b	0.02
	Total Solids (%)	15.70	15.98	15.88	0.05
31 to 45 days	Milk Fat (%)	6.82	6.89	6.86	0.04
	Milk SNF (%)	9.08^a	9.19^b	9.28^c	0.02
	Total Solids (%)	15.90	16.08	16.14	0.04
46 to 60 days	Milk Fat (%)	7.01	7.11	7.10	0.05
	Milk SNF (%)	9.18^a	9.30^b	9.40^c	0.02
	Total Solids (%)	16.19	16.41	16.50	0.08
61 to75 days	Milk Fat (%)	7.12	7.18	7.11	0.05
	Milk SNF (%)	9.29^a	9.46^b	9.54^c	0.02
	Total Solids (%)	16.41	16.64	16.65	0.06
76 to 90 days	Milk Fat (%)	7.23	7.24	7.16	0.05
	Milk SNF (%)	9.36^a	9.56^b	9.67^c	0.01
	Total Solids (%)	16.59	16.80	16.83	0.05

^{abc}Values in the rows bearing different superscripts differ significantly (*P<0.05)

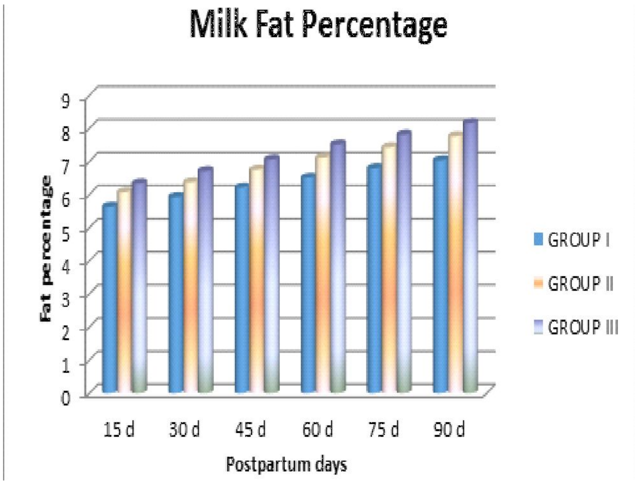

Fig 2: Effect of various dry period lengths on milk fat percentage of Murrah Buffaloes.

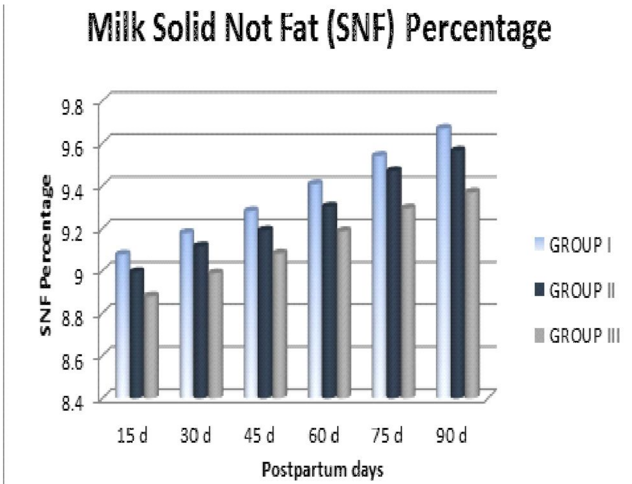

Fig 3: Effect of various dry period lengths on milk solids not fat (SNF) percentage of Murrah Buffaloes.

(P>0.05) improvement of total solids percentage was observed in group III, followed by group II and I, respectively (Fig. 4). Likewise, Pezeshki *et al*. (2008) observed an unaltered total Solids percentage in the cows with 28 Vs 49 DP, and 35 Vs 65 DP, respectively. Dairy animals with a high genetic milk production potential can maintain total milk solids percentage even with the decreased length of the dry period (Anderson *et al*., 2005).

Reproductive performance: Total days required for conception were highest (P<0.05) in group I buffaloes (144.38 ± 5.62) followed by group II (105.00 ± 5.07) and group III (86.25 ± 5.39) buffaloes. Improved energy status in a short dry period group will fasten the postpartum ovulation, thus decreasing the service period and increasing reproductive efficiency (De Feu *et al*. 2009). Besides, the total number of services required for conception was more in group I, compared to the other two groups, indicating a reduced quality of oocytes (Butler, 2000). However, Pezeshki *et al.* (2008) observed no effect on days open, conception rate, pregnancy rate between dairy cows with 28 and 49 days DP.

Correlation coefficients of serum glucose levels and 6 % FCM: The correlation coefficients of serum glucose levels and 6% FCM are presented in Table 3. Although not significant, 6% FCM had a negative correlation with Serum Glucose values at 30d postpartum, followed by a significant positive (P<0.01) correlation at 60 or 90 d postpartum. The observed negative correlation at 30 d postpartum period might be attributed to the higher milk production driven

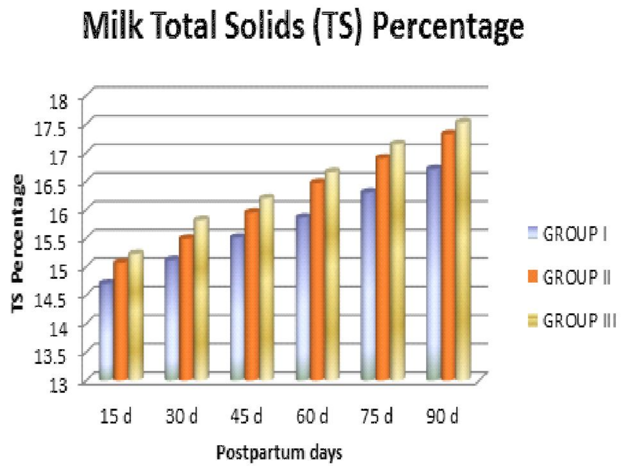

Fig 4: Effect of various dry period lengths on Total Solids (TS) Percentage of Murrah Buffaloes.

excessive body reserves mobilization and low DMI, together causing a rapid decrease in serum glucose concentrations. The positive correlation after 60 d postpartum is more of an intake factor which tremendously increases around 60 days after calving, thereby increasing the serum glucose concentration and milk yield in parallel.

CONCLUSION

Despite no significant improvement in milk production was noticed for short dry periods, there were increased levels of milk fat and milk SNF percentage, and decreased service period and calving interval compared to the traditional dry period length. A short dry period extends

Table 3: Correlation coefficients of Glucose and 6%FCM for high yielding Murrah Buffaloes at 30, 60, and 90 d post partum.

Parameter	**30** d **Postpartum**		**60** d **Postpartum**		**90** d **Postpartum**	
	Glucose	**6%FCM**	**Glucose**	**6%FCM**	**Glucose**	**6%FCM**
Glucose	1	-.154	1	.607* 1	.719*	
6%FCM	-.154	1	.607*	1	.719*	1

*P<0.01

the lactation phase before drying off, thus providing additional milk. Further, the service period in shortened dry period length groups is less, revealing an early calving and higher lifetime milk production. In the present study, it is concluded that shortened DP is advantageous and would be more economical for farmers compared to traditional dry period lengths.

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