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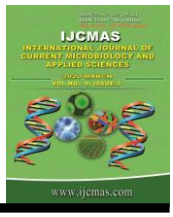

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Effect of prepartum dry period on the postpartum body weight and milk yield of dairy buffaloes

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A B S T R A C T

This study was conducted with an objective to find the relation between pre-partum dry period and body weight or milk yield at 1-month post-calving. The recordings were made by using data records of seven buffalo farms in and around Nellore district of Andhra Pradesh. Only the buffaloes with proper records and identification measures were taken into account. According to the collected dry period data, the average body weight and milk yield at 1-month post-partum were higher in the buffaloes with larger dry period (>2 months) compared to smaller dry periods (<2 months). The predicted equation generated for short dry period group of buffaloes is Y = -16.747 + 0.290 (DP) + 0.015 (BW), while the same for long dry period group is Y = 11.937 - 0.035 (DP) + 0.013 (BW). The coefficient of determination (R-squared) was higher for short dry period buffaloes compared to those with long dry period. Significant (P<0.01) positive correlations were observed for dry period with body weight and milk production. In conclusion, the dry period of more than 2 months is required in buffaloes to obtain higher milk yield in subsequent lactation. Further, the regression and correlation studies project pre-partum dry period and body weights as good predictors for post-partum milk yield.

Introduction

Dry period is a vital phase of the lactation cycle. Several authors found a high correlation among prepartum dry period and milk yield in subsequent lactation (Reddy *et al.*, 2017a). During the dry period, energy and protein requirements are lower, as there are no needs by the udder for milk production. In the last trimester of pregnancy, the fetus

grows enormously exerting pressure on the rumen and sending negative signals to the satiety centre of hypothalamus on voluntary feed intake (Reddy *et al.,* 2016). Generally, last trimester of pregnancy concurs with the dry period. Hence, although the animal in dry period does not need high amounts of energy and protein for milk, nutritional care should be taken for growing foetus.

Animals should be given sufficient time to rest and regenerate mammary tissue, which can be attained by providing a dry period of 45 to 60 days duration (Rastani *et al.,* 2005). Dry period of limited days is accompanied by several physiological and biochemical changes exerting stress to animals and thus making them more susceptible to various metabolic and infectious diseases (Goff and Horst, 1997; Mallard *et al.,* 1998) resulting in monetary losses to dairy farmers. Besides, the improper feeding practices during pre-partum dry period are associated with increased risk of metabolic disorders like Ketosis, retention of placenta and Downer cow syndrome after calving, thus reducing the milk production.

The method of complete cessation of milking is a common practice in the low producing dairy animals (<6 kg). In case of high yielders, incomplete milking or alternate day milking for 1-2 weeks followed by complete cessation is an effective method to dry off the animals. However, recent literature showed that the dry period of limited days, preferably less than 45-60 days might provide beneficial results in terms of milk production (Reddy *et al.,* 2019). The literature pertaining to the dry period management in buffaloes is scanty. Hence, this work was conducted with the objective of estimating the post-partum milk yield and body weight with relation to the pre-partum dry period in buffaloes. Dry period is a vital phase of the lactation cycle. Several authors found a high correlation among prepartum dry period and milk yield in subsequent lactation (Reddy *et al.,* 2017a). During the dry period, energy and protein requirements are lower, as there are no needs by the udder for milk production. In the last trimester of pregnancy, the fetus grows enormously exerting pressure on the rumen and sending negative signals to the satiety centre of hypothalamus on voluntary feed intake (Reddy *et al.,* 2016). Generally, last trimester of pregnancy concurs with the dry period. Hence, although the animal in dry period does not need high amounts of energy and protein for milk, nutritional care should be taken for growing foetus.

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yield and body weight with relation to the pre-partum dry period in buffaloes.

Materials and Methods

One hundred and fifty multiparous graded Murrah and Murrah buffaloes were identified from seven buffalo farms of Nellore district, Andhra Pradesh, India. All the buffaloes were fed adlibitum green fodder and concentrate mixture as per the dairy requirements. The data of seventy buffaloes were not taken into account because of lack of proper records, absence of identification measures, presence of diseases, and underweights.

Pre-partum dry periods

The data pertaining to pre-partum dry periods of the individual buffaloes were collected by using the lactation record in the farms. The number of days between complete cessation of lactation and calving was considered as pre-partum dry periods. The days were partitioned into two components viz., dry period less than 60 days (< 2 months) and more than 60 days (> 2 months).

Milk yield

The data of one-week milk cumulative yield (including both morning and evening yields) at the end of first-month post-parturition was selected for the study. The weekly milk yield was averaged to obtain milk yield on day basis.

Body weights

The data of length and girth of the buffalo was taken by using a measuring tape. The body length of Murrah buffaloes was measured using a measuring tape from the point of shoulder to the point of pin bone. The heart girth was measured by drawing the measuring tape around the area behind front legs, a point slightly behind the shoulder blade, down the fore-ribs. The body weights were determined by using Shaeffer's formula (Sastry *et al.*, 1983);

Body weight (Pounds) = $LG^2/300$
Where, L = Length of the animal in inches, and G = Heart girth of the animal in inches (1 inch = 2.5 cms and 1 kg = 2.5 pounds).

Prediction equations

Equations for milk yield prediction were developed by using the linear Regression equation;

$Y = B_O + B_1X_1 + B_2X_2 + \ldots\ldots\ldots + B_PX_P + E_P$
Where,
Y: Predicted score of dependent variable
B: Intercept
P: Number of predictors
B_1-B_p: Weights or partial regression coefficients for predictors / slope
X_1-X_P: Scores of predictors
E_P: Errors of prediction
R-squared is calculated as; $R^2 = 1 - (SS_{regression}/SS_{total})$
F value is calculated as; F = Larger sample variance/Smaller sample variance.

Correlation analysis

The data of prepartum dry period (days), milk yield (lt/d), and body weights (Kg) were analyzed for statistical correlation (two-tailed test of significance) by using Pearson coefficient.

Statistical analysis

The sample size of the two groups are unequal and the data violated the assumption of homogeneity of variances. Hence, the means were compared by one-way ANOVA with Welch's correction. The '*P*' value less

than 0.05 and 0.01 is considered as significant at 5% and 1% level of significance, respectively. Entire statistical analysis, correlation analysis, generation of prediction equations were done by using SPSS version 23.0.

Results and Discussion

Body weight and milk yield of the dairy buffaloes at the end of 1-month post-partum period were shown in Table 1. The scatter plot of body weights and milk yield with concerning pre-partum dry periods were presented in Figure 1 and 2, respectively. The average body weights of the graded Murrah buffaloes were higher (P<0.05) in the LDP group. The difference in body weights was conspicuous and as high as 22.85 kg. Higher body weights may prevent metabolic diseases during post-parturient periods. On contrary, Reddy *et al.,* (2018a) reported that shortened dry periods (either 45 or 60 d) are more beneficial in maintaining the body weights. However, these authors conducted the study on high yielding milch animals with more than 15 liters milk production. Same researchers team also confirmed that the buffaloes allotted to short dry periods adapt more to the negative energy balance and experience fewer metabolic imbalances both in pre and post lactation periods (Reddy *et al.,* 2018b).

Higher (P<0.05) milk production was recorded in LDP group of buffaloes compared to those with pre-partum dry period of less than 2 months. The buffaloes with LDP might have less stress and higher blood glucose levels compared with those having short pre-partum dry period. The blood glucose levels during post-parturient period vary highly with the variation in number of days of pre-parturient dry period (Reddy *et al.,* 2017c). The dry period of more than 60 days allows mammary tissue to recover and repair (Seeth *et al.,* 2015). Further, the long dry period provides chance to cure existing infections, if any. The dry period is necessary to facilitate cell turnover in the bovine mammary gland and to optimize milk production in the next lactation cycle (Capuco *et al.,* 1997). A typical dry period in a dairy cow involves active involution after cessation of milk removal followed by a period of redevelopment before the next lactation cycle (Hurley, 1989). Earlier research showed that complete removal of dry period might decrease the milk yield by 25% to 30% by next lactation (Watters *et al.,* 2018). However, the results obtained in the present study are notwithstanding with Reddy *et al.,* (2019b) in high yielding Murrah buffaloes. They revealed that neither of the dry period allotments influenced milk yield and its parameters, except for milk fat percent. The difference in results could also be attributed to parity effect, which changes the milk yield and certain endocrinal parameters according to the prepartum dry periods. Unfortunately, we were not able to record the effect of parity due to lack of previous records within the farms. Multiparous animals are least affected with pre-partum dry periods compared to uniparous cows or buffaloes (Neave *et al.,* 2017).

The predicted equation generated for short dry period group of buffaloes is Y = -16.747 + 0.290 (DP) + 0.015 (BW), while the same for long dry period group is Y = 11.937 - 0.035 (DP) + 0.013 (BW). Likewise, prediction equations were developed for milk yield by using pre-partum dry period, serum non-esterified fatty acids, serum glucose, body weight, and body condition score as independent predictors (Reddy *et al.,* 2017a). The coefficient of determination (R-squared (R^2) is a statistical measure that represents the proportion of the variance for body weight of milk yield that is explained by pre-partum dry period (days) in a regression

model (Fig. 1 and 2). On analyzing the R and R^2 values, the higher power of prediction was noticed in SDP group compared to LDP groups. The coefficient of determination factor indicates that the variations in milk production and dry period were more related to the alterations in dry period of less than 2 months (SDP). Further, the higher F value of SDP group indicates the presence of lower variation within the group.

The correlation coefficients among dry period, body weight, and milk production of the current study were provided in Table 3. Significant (P<0.01) positive correlations were observed for dry period with body weight and milk production. However, the relationship between body weight and milk production was not significant. Similarly, correlations among the 6% fat corrected milk (6% FCMY), body weight (BW), body condition score (BCS), serum glucose (SG), serum non-esterified fatty acids (SNEFA), and pre-partum dry periods (DP) were found in high yielding Murrah buffaloes (Reddy *et al.*, 2017b). They reported a strong linear correlation between 6% FCMY and BW, BCS, SG, and SNEFA values, indicating the potentiality of the serum metabolites and physical indicators in predicting negative energy balance and milk yield in high yielding Murrah Buffaloes.

Table.1 Body weight and milk production of the dairy buffaloes as per the pre-partum dry period

Parameter	Pre-partum dry period		SEM	'P' value
	SDP	LDP		
Body weight	499.88	522.65	4.34	0.013
Milk production	7.27	8.17	0.19	0.027

(n=26 for SDP and 54 for LDP) SDP -Short dry period (< 2 months), LDP - Long dry period (> 2 months), SEM - Standard error mean

Table.2 Prediction equations for milk production of the dairy buffaloes

Pre-partum dry period	Equation	R	R^2	'F' Value
SDP	Y = -16.747 + 0.290 (DP) + 0.015 (BW)	0.606	0.367	6.657
LDP	Y = 11.937 - 0.035 (DP) + 0.013 (BW)	0.335	0.113	3.234

(n=26 for SDP and 54 for LDP) SDP – Short dry period (< 2 months), LDP – Long dry period (> 2 months), SEM – Standard error mean, Y – Milk production (Lit/day), DP – Prepartum dry period (days); BW – Body weight (Kg)

Table.3 Correlation coefficients among dry period, body weight, and milk production

Parameter	Dry period	Body weight	Milk production
Dry period	1	0.470**	0.319**
Body weight	0.470**	1	0.146
Milk production	0.319**	0.146	1

** P<0.01

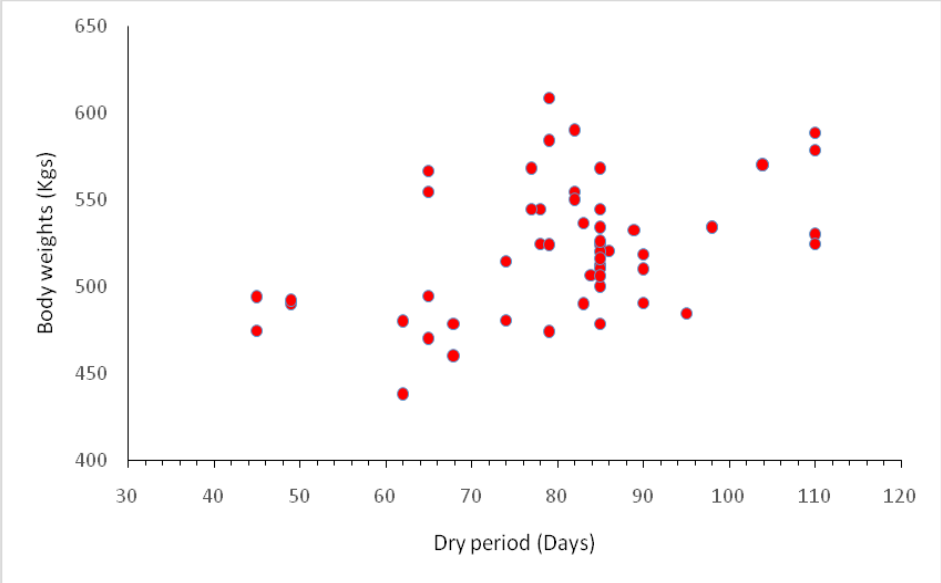

Figure.1 Scatter plot of body weights according to the pre-partum dry period of buffaloes

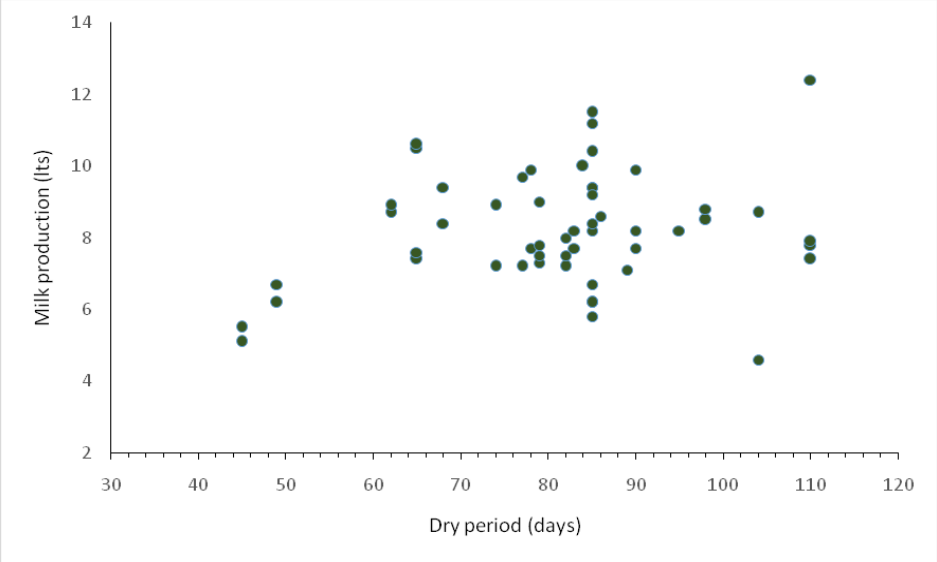

Figure.2 Scatter plot of milk production according to the pre-partum dry period of buffaloes

The study concluded that the dry period of more than 60 days is required in buffaloes to obtain higher milk yield in the subsequent lactation. Further, the higher body weights during the first month post-partum indicate a decreased tendency of negative energy balance in lactating buffaloes with long dry periods. The regression analysis and correlation coefficients show that the pre-partum dry period and body weight could be good predictors for milk yield.

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