Correlation between Milk Production Traits, Certain Hormones and Serum Biochemical Parameters in Lactating Murrah Buffaloes

K.B. Bahiram[1]*, J.R. Khan and J.P. Korde[1]

Department of Veterinary Physiology and Biochemistry

College of Veterinary Science & AH, Anjora, Durg – 491001 (CG)

[1]Department of Veterinary Physiology, MAFSU, Nagpur – 440006 (MS)

Corresponding Author: dr_kbbahiram@rediffmail.com

Abstract

The objective of the study was to evaluate correlation between milk yield (MY), milk components (fat, protein and lactose), hormones (T_3, T_4, insulin and GH), blood metabolites (glucose and NEFA) and blood macro-minerals (Ca, P and Mg) during entire lactation based on 161 observations of 07 Murrah buffaloes. The average Lactation length recorded was 338.57 ± 10.64 days. The correlations between MY and milk composition, hormones with MY and milk composition, blood metabolites with MY and milk composition and blood macro-minerals values with MY and milk composition during the entire lactation were evaluated. The results indicated that the relationship of blood hormones, energy metabolites and blood macro-minerals parameters would help to understand the role of each of them in understanding the lactational physiology of buffaloes in relation to endocrine regulation and nutritional partitioning.

Key words: Murrah buffaloes, Lactation, Milk yield, Milk composition, Hormones, Energy metabolites.

Introduction

Milk is a fluid secreted by the mammary glands of mammals to feed their young ones. Milk being rich in carbohydrate, protein, fat, vitamins and minerals, is a good source of nutrients and is important for growth, repair and energy. The nutritive value of milk varies with its composition. The composition of buffalo milk is of greatest importance for the dairy industry and consumers. The price of milk and consumer's interest vary with milk components, which may directly affect the farm income. A number of factors such as genetic, climatic, disease, feeding, year of calving and management have been reported to affect milk production in the tropics (Msanga *et al.,* 2000). The information on influence of various metabolic hormones on milk composition and yield in complete lactation of Murrah buffaloes is scanty. Glucose and non-esterified fatty acids (NEFA) have been used to access energy status of ruminants (Khan, 1998). Lactating dairy animals in positive energy balance have greater reproductive function than in negative energy balance (Spicer *et al.*, 1990). All animals require minerals such as calcium (Ca), magnesium (Mg) and phosphorus (P) for growth, reproduction and lactation, which often function as cofactors of enzymes or regulate several mechanisms involved in pregnancy and lactation. Information about the correlation of MY,

milk composition, hormones, blood metabolites and biochemical values in buffaloes is scanty. Hence, the present study was designed to evaluate the same during entire lactation in lactating Murrah buffaloes.

Materials and Methods

The study was conducted on 07 Murrah buffaloes from Jagdamba Dairy Farm, Bhillai, Durg. The animals having 2nd to 4th parity were selected. Blood samples (total 161) of lactating buffaloes were collected on 7th day of parturition and thereafter at fortnightly intervals from each animal in clot activated tubes from jugular vein at 7.00 AM before feeding. Serum was separated out in refrigerated centrifuge machine at 3000 rpm for 20 min and was stored at -20°C until analysis of hormone, blood metabolites and macro-minerals. Milk samples were also collected on the same days of blood sampling, and milk yield was recorded for each sampling day. Milk composition was determined by automatic milk analyzer (Lactostar, Funky Gerber, Germany make) for fat, protein and lactose. The blood glucose level was analyzed immediately after collection of blood by Accu-check glucometer. Hormone analysis of T_3, T_4, insulin and GH concentration in serum was determined by RIA method. The serum NEFA concentration was determined by extraction method (chloroform: heptane: methanol, 49:49:2) as per Shipe et $al.$ (1980). The serum Ca, P & Mg was determined by semi auto analyzer using biochemical kits. Statistical analysis was carried out as per standard method (Snedecor and Cochran, 1994) using SPSS version 20.00.

Results and Discussion

The data obtained from 161 observations in Murrah Buffaloes during complete lactation were subjected to analysis of correlation coefficients (value of regression r) of MY, and milk composition with blood metabolites, serum hormones and macro-minerals are presented in tables 1 to 3 and the results of interrelations between MY, milk composition, hormones, blood metabolites and macrominerals parameters are discussed.

Correlation between milk yield and milk components

A highly significant (P<0.01) negative correlation of milk yield with milk fat % (r = -0.879) recorded in the study indicated that selection of high milk yield may result into reduction in fat per cent in Murrah buffaloes. Yogi et $al.$ (2017) reported similar negative correlation in crossbred cows.

Highly significant (P < 0.01) positive correlations of milk yield with milk protein % (r = 0.937) and lactose % (r = 0.918) were observed in the present study. Jacob et $al.$ (2014) and Yogi et $al.$ (2017) however reported negative and non- significant correlation of milk yield with milk protein % and milk lactose % in crossbred cattle. Babu Rao and Jayaramakrishna (1983) reported significant negative correlation of milk yield with milk protein % in Ongole cows and negative but non-significant correlation in crossbred cows. The correlations of these studies suggest that there is a tendency

Table No. 1: Correlation coefficient (r) # between milk yield and milk components during complete lactation period in Murrah buffaloes

	MY (Kg)	Milk Fat %	Milk Protein %	Milk Lactose %
MY (Kg)	1			
Milk Fat %	-0.879[**]	1		
Milk Protein %	0.937[**]	-0.830[**]	1	
Milk Lactose %	0.918[**]	-0.797[**]	0.931[**]	1

N=161 observations ,P0.05 , P 0.01

Table No. 2: Correlation coefficient (r) # between hormones with milk yield and milk components during complete lactation period in Murrah buffaloes

	MY (Kg)	Milk Fat %	Milk Protein %	Milk Lactose %
T_3 (ng/ml)	0.446[*]	-0.317	0.402	0.413
T_4 (ng/ml)	0.524[*]	-0.465[*]	0.604[**]	0.485[*]
Insulin (μU/ml)	0.591[**]	-0.397	0.535[**]	0.508[*]
GH (ng/ml)	0.611[**]	-0.573[**]	0.562[**]	0.580[**]

N=161 observations ,P0.05 , P 0.01

Table No 3: Correlation coefficient (r) # between blood metabolites and macromineralswith milk yield and milk components during complete lactation period in Murrah buffaloes

	MY (Kg)	Milk Fat %	Milk Protein %	Milk Lactose %
Glucose (mg/dl)	-0.726[**]	0.722[**]	-0.642[**]	-0.621[**]
NEFA (mMol/L)	-0.950[**]	0.817[**]	-0.933[**]	-0.878[**]
Ca (mg/dl)	0.846[**]	-0.691[**]	0.839[**]	0.783[**]
P (mg/dl)	0.926[**]	-0.792[**]	0.902[**]	0.871[**]
Mg (mg/dl)	0.418[*]	-0.288	0.501[*]	0.467[*]

N=161 observations ,P0.05 , P 0.01

for increase in milk protein % and milk lactose % with increase in milk fat % in crossbred cattle and in Ongole cows.

In the present investigation, significant (P<0.01) inverse correlations of milk fat % with milk protein % (r = -0.830) and lactose % (r = -0.797) were found. The milk protein % has significant (P<0.01) positive correlation with milk lactose (r = 0.931). This indicates that milk protein % may be associated with milk lactose % in Murrah buffaloes. This finding is in agreement with Yogi *et al.* (2017). These correlations suggest that in Murrah buffaloes as the milk fat % increased there is tendency for milk protein % and milk lactose % to decrease. More extensive studies in Murrah buffaloes are required to support the present findings.

Correlation of hormones with milk yield and milk components

The serum T_3, T_4, (P<0.05) insulin and GH had highly significant (P<0.01) positive correlations with milk yield (Table 2). Significant positive correlations of the metabolic hormones noticed on the MY of Murrah buffaloes indicate the role of these hormones on overall increase in milk production. Jindal and Ludri (1994) reported positive relationship of T_4 and GH with MY and non-significant negative relationship of T_3 and insulin with MY in buffaloes. These variations in correlationship might be due to different sampling intervals.

Correlation of blood metabolites and minerals with milk yield and milk components

The blood glucose and NEFA concentration showed highly significant (P<0.01) negative correlations

with milk yield, milk protein % and milk lactose %, whereas they had highly significant (P<0.01) positive correlations with milk fat %. Jindal and Ludri (1994) reported positive relationship of growth hormone with NEFA, which suggest that high growth hormones levels may result in fat mobilization and thereby increase the availability of energy precursors for milk synthesis. Nagre and Kuralkar (2017) reported significant positive correlation between insulin and glucose in Murrah buffaloes. In present investigation the negative correlation between metabolic hormones and milk fat % justify the negative correlation between metabolic hormones and NEFA and positive correlation of milk fat % with NEFA.

The blood Ca, P and Mg concentration showed highly significant (P < 0.01) and significant (P<0.05) positive correlation with milk yield, milk protein % and milk lactose %. Serum calcium and phosphorus output is directly related to milk yield, as phosphorus concentration is constant (Nale, 2003). In fact, increasing the milk production, more minerals from the ingested amount is transferred to milk and less is excreted with faeces. The decreasing in phosphorus and magnesium concentration in milk was likely in part due to dilution resulting from increased milk production (Nale, 2003; Karapehlivan *et al.*, 2007).

The results of the present study are insufficient to draw definite conclusion, however it certainly indicates that the milk fat % and NEFA have an unique regulatary mechanism in buffaloes.

Conflict of Interest: All authors declare no conflict of interest.

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