Alterations in haemato-metabolic status and body condition score of buffaloes during the transition period

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Journal of Livestock Science (ISSN online 2277-6214) 7: 122-125
Received on 4/4/2016; Accepted on 28/4/2016

Abstract

The transition period of 12 high yielding buffaloes was monitored to assess the alterations in haemato-metabolic status and body condition. Total and differential leukocyte counts, blood glucose, BUN and NEFA were estimated. Body condition score was assessed on 1-5 scale. Results revealed an increase in neutrophils and monocytes at calving. Glucose, BUN and NEFA concentrations peaked at calving, the levels at 3-week postpartum were higher as compared to the prepartum values. Mean body condition score at calving and at 30 days in milk was 3.48±0.13 units and 3.23±0.11 units respectively.

Key words: Glucose, BUN, NEFA, Body condition score, transition period, buffalo

Introduction

Buffalo 'the black gold of India' is the preferred milch animal of the farmers in India. Milk yield of an average indigenous buffalo is nearly 3 times that of an average indigenous cow. The success of buffalo husbandry lies in ensuring proper and optimal reproductive rhythm of individual animals in the herd. During the critical peripartum period, feed intake is at the lowest point of the lactation–gestation cycle. This period is characterized by negative energy balance (NEB), fat mobilization, and elevation of circulating non-esterified fatty acids and ketone bodies.Major metabolic transitions occur in a dairy animal as she converts from a non-lactating to a lactating state and undergoes the stress of parturition. Clinical and subclinical health in the transition period (roughly defined as three weeks prior to calving until three weeks after calving) is associated with uterine health and subsequent reproductive performance (Gressley, 2008). Increased understanding of the biology of the transition period should decrease health problems and increase profitability of dairy cows (Drackley, 1999). Little information on this aspect is available for buffaloes. Therefore the study aimed to assess the alterations in haemato-metabolic parameters and body condition during the transition period in high yielding buffaloes.

Materials and Methods

Animals and blood sampling

The study was conducted in an organized private dairy farm of Jabalpur following uniform feeding practices as per standard norms given by NRC (2001). Twelve pregnant graded Murrah buffaloes in 2^{nd} to 5^{th} parity, having peak milk yield of 10 litres or greater in previous lactation and due to calve after three weeks were enrolled for the study.To minimize the effect of season, calvings in a two-month period of November-December were pre-selected. Blood samples (~6 ml) were collected aseptically on days -21, day 0 (Day of calving), and day +21 by jugular venupunture for the assessment of haematological parameters and blood metabolites.

Haematological parameters

Fresh blood smears were prepared on the spot for differential leukocyte count (DLC %). The slides were marked and stained with Leishman's stain. Smears were evaluated under oil immersion (1000x) following standard procedure (Benjamin, 2001). Total leukocyte count (TLC, thousands/µl) was conducted in fully auto hematology analyzer (PE-6800 VET, Shenzhen Procan Electronics Inc., China) within 12 h post collection.

Estimation of Blood Metabolites

Blood glucose (mg/dl) was estimated on the spot with glucometer and blood glucose test strips (Ascensia® Entrust, Bayer HealthCare, USA). Blood urea nitrogen (mg/dl) was estimated in plasma samples using semi-automatic analyzer (CHEM-5 PlusV2, Erba Mannheim, Germany) and commercial kit. Estimation of Non Esterified Fatty Acids (NEFA) in plasma was done by the copper soap solvent extraction method modified by Shipe et al. (1980) and the standard curve was prepared as per Koops and Klomp (1977).

Body Condition Score (BCS)

Body condition of buffaloes was assessed as per chart given by Anitha et al (2010) for Murrah and Graded Murrah buffaloes in a 1 to 5 scale using 0.5 increments. Scoring was done on the day of calving and again at 30 days in milk (DIM). Loss in BCS units from calving till day 30 was worked out.

Results and Discussion

Results show that the total leukocytes increased non-significantly on the day of parturition compared with before and after calving. An increase in monocytes and neutrophils accompanied by decrease in per cent lymphocytes and eosinophils at calving was evident (Table-1). This increase may be in response to challenge the risk of general and uterine infections at calving. The eosinophils increased again at 21 DIM. Similar trend around parturition in relation to the dry period and 4 weeks in milk have been reported by Meglia (2004). A decrease in eosinophils around calving was also reported by Quiroz-Rocha et al. (2009) and was opined to result from the stress (cortisol mediation) associated with parturition.

The results of blood metabolites during transition period are presented in Table 1. Analysis of Variance technique showed significant ($P<0.05$) difference between pre- and post-calving glucose levels. PostpartumBUN and NEFAconcentrations were higheras compared to the prepartum mean values, peaking at calving. The difference was highly significant ($P<0.01$) for NEFA.

Higher levels of glucose recorded on the day of calving may be the result of transient stress (cortisol mediation) associated with parturition. One dystocia-affectedbuffaloshowed higher spike (91 mg/dl) on the day of calving which may have resulted from increased glucagon and glucocorticoid concentrations. Dann et al. (1999) found that in cows, the glucose concentrations increased dramatically from 2 days prior to calving (68 mg/dl) to calving (84 mg/dl) and then decreased immediately after calving (59 mg/dl). The results of the present

study are in contrast with those of Hagawane et al (2009) who reported significantly higher blood glucose in dry buffaloes (52.72±4.22 mg/dl) than the early lactating buffaloes (37.54±3.44 mg/dl).

Table 1: Leukocyte counts and blood metabolites (mean±SE) in buffaloes during the transition period

Particulars		Days relative to calving		
		-21	0	+21
TLC ($x10^3$/µl)		10.34±0.69	10.63±0.82	10.44±0.62
DLC (%)	Lymphocytes	57.86±1.12	55.14±0.96	57.43±1.13
	Neutrophils	35.71±1.19	38.43±0.72	35.71±0.84
	Monocytes	$4.14±0.40^{a}$	$5.57±0.37^{b}$	$4.0±0.49^{a}$
	Eosinophils	$1.86±0.26^{AB}$	$0.86±0.26^{A}$	$2.71±0.56^{B}$
	Basophils	0.29±0.18	0.0±0.0	0.14±0.14
Metabolite	Glucose (mg/dl)	$48.57±1.56^{a}$	$71.57±3.94^{b}$	$58.57±4.32^{c}$
	BUN (mg/dl)	15.44±0.91	21.89±2.24	20.14±2.45
	NEFA (µmol/L)	$236.43±6.82^{A}$	$300.14±8.09^{B}$	$297.85±5.27^{B}$

Values with different superscripts $^{a\&b}$vary significantly ($p<0.05$) within a row

Values with different superscripts $^{A\&B}$ vary significantly ($p<0.01$) within a row

In ruminants, glucose is mainly synthesized through the process of gluconeogenesis that occurs mainly in liver by utilizing substrates such as ruminal volatile fatty acids that result from fermentation of dietary glucose in the rumen (Kaneko et al., 1997). In lactating cows, if there is a mismatch between mammary drain of glucose for lactose synthesis and gluconeogenesis via inadequate energy intake, the cow will have negative energy balance (NEB) resulting in hypoglycemia (Kaneko et al., 1997).Circulating glucose levels are affected by a number of factors viz, time of feeding, nutritive values of the diets, social or environmental stress conditions, physiological status of the animal etc. (Terzano et al., 2005). Glucose concentrations are under tight homeostatic control and are regulated by various hormones such as insulin, cortisol, glucagon, somatotropin and adrenaline. Therefore, although glucose has a central role in metabolism, it is a poor analyte for monitoring or investigating herd problems (Herdt 2000).

In the present study, plasma urea nitrogen and NEFA concentrations were highest at calving. The BUN values are indicators of total protein intake and mobilization of tissue protein.Literature shows that blood urea level is influenced by the days in milk (Campanile et al., 1997 and Grasso et al., 2004) in addition to diet and season. The concentration of NEFA in blood reflects the degree of adipose tissue mobilization, therefore, the greater the extent of negative energy balance, the more NEFA are released from body fat and the higher the concentration of NEFA in blood. Other factors (impending parturition, stress, previous nutritional history, etc.) also have an important influence on plasma NEFA concentration (Terzano et al., 2005). Slightly higher NEFA concentrations were reported by Mishra et al (2007) and Khan et al (2011) than in the present study.

Body condition score is a measure of the total amount and mobilization of body fat (Butler and Smith 1989) and has a strong relationship with production and fertility of dairy animal (Pryce et al., 2001). The loss in BCS during the postpartum period appears to have a strong relationship with reproductive performance than the absolute BCS at calving. It has been reported that the higher the BCS at calving, the more BCS will be lost in earlylactationand that the animals losing excess BCS are less fertile than those that maintain BCS well (Buckley et al., 2003).

In the present study, body condition score (1-5 scale, Mean ± SE) at calving (3.48±0.13 units) did not differ significantly ($p>0.05$) from BCS one month later (3.23±0.11 units) and a loss in BCS of 0.25±0.04 units from calving to 30 DIM was recorded. Individually, none of the buffaloes in the present study lost more than 0.5 units in body condition scoreduring the first 30 DIM, indicating a good nutritional status in the herd.The average milk yield at 30 days of lactation was 10.56±0.42 kg/day.

The paper provides reference limits for hematological and metabolic analytes in dairy buffaloes during the 6-week transition period. It can be concluded that physiological alterations in the metabolites, leukocytes and body condition do occur around calving in buffaloes and their monitoring may provide useful information regarding the energy and immune status of the herd.Further studies in different seasons are required before drawing limits that necessitate supplementation over and above the normal in a herd.

Acknowledgment

This work is a part of doctoral research of first author conducted at Nanaji Deshmukh Veterinary Science University, Jabalpur as a sponsored candidate by SKUAST-J, Jammu. The authors are thankful to Dr. D.S. Tomar and the dairy farm owner for facilitating blood sampling.

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