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# Passive transfer status and growth performance in newborn buffalo calves allowed to nurse the dam

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**ABSTRACT:** The objective of this study was to evaluate the effect of passive transfer status, determined by measuring serum IgG concentration 24 hours after parturition, on growth performance in buffalo calves fed milk replacer or allowed to nurse the dam during the first month of life. Experiment consisted of 24 healthy buffalo calves from birth to 30 days old. Significant quadratic associations were detected between serum IgG concentration 24 hours after birth and day-30 weight ( $P < 0.05$ ;  $R^2 = 0.62$ ) and between serum IgG concentration 24 hours after birth and the mean daily gain from birth to day 30 ( $P < 0.01$ ;  $R^2 = 0.74$ ) in buffalo calves allowed to nurse the dam. No significant association was detected between serum IgG concentration 24 hours after birth and measures of growth performance in buffalo calves fed milk replacer. Results indicated that passive transfer status, determined as serum IgG concentration 24 hours after birth, was a significant source of variation in growth performance when buffalo calves nursed the dam. Maximizing passive transfer of immunity by allowing buffalo calves to nurse the dam increased the growth performance during the first month of life.

**Key words:** Buffalo calf, Immunoglobulin, Growth.

**INTRODUCTION** - Colostrum feeding in ruminants is the one way to get maternal antibodies (Lombardi *et al.*, 1996). An inadequate ingestion or absorption of colostrum IgG leads to a secondary immunodeficiency condition termed Failure of Passive Transfer (FPT) that predisposes ruminant neonates to the development of bacterial septicaemia and common neonatal diseases (Barrington and Parish, 2002). Calves with FPT have an increased risk of death until at least 10 weeks of age and in neonatal calves < 7 days old, an increased risk of death is associated with serum IgG concentration of < 10 mg/mL or, 1,000 mg/dL (Barrington and Parish, 2002). The importance of colostrum IgG intake is not only due to the early stages of life but also to subsequent growth and production of the juvenile ruminant. Passive transfer of immunity seems to have predictive value for health and productivity outcomes in juvenile calves and lambs, both before and after weaning (Massimini *et al.*, 2006).

In this context no data on the effects of passive transfer status on growth performance in buffalo calves has been reported yet. Since buffalo is mainly bred for milk production, the use of milk replacers soon after birth is a common practice of farm management. Despite that, no data are available about the relationship between IgG intake, growth performances, and postcolostral feeding in calves. The lack of such data is critical since a very high mortality is reported for buffalo calves and the critical role of colostrum and post colostrum feeding has already been hypothesized (Lombardi *et al.*, 2001). For these reasons, the aims of this study were to evaluate the relation between the effect of passive transfer status, determined by measuring serum IgG concentration 24 hours after parturition, and the influence of postcolostral feeding on growth performance in buffalo calves during the first month of life.

**MATERIAL AND METHODS** - Experiment consisted of 24 healthy buffalo calves from birth to 30 days old. Colostrum quality was assayed by Colostrometer® and only calves receiving high quality colostrum were included in the trial. Buffalo calves were randomly separated ( $n = 12/\text{group}$ ) from the dam at 5 days postpartum and fed milk replacer (group 1) or allowed to nurse the dam (group 2). According to the farmer's practice after suspension (180g/liter) milk replacer was given twice a day in the following way: from day 5 to 15, 6 litres/day; from day 16 to 30, 8 litres/day. Total protein was determined by using biuret method (Fleury *et al.*, 1951). Serum  $\gamma$ -globulin concentration was determined by use of a commercially available reagent kit for serum protein determination (Hydrigel Protein, Sebia). Body weight was measured at birth and at 30 days after birth. The mean daily gain (MDG) from birth to day 30 and day-30 weight were used as measures of growth performance. Mean  $\pm$  SD values for serum IgG concentration at 24 hours, birth weight, day-30 weight, and MDG from birth to day 30 were calculated. Serum IgG concentrations 24 hours after birth and measures of growth performance were compared between the two groups by use of an unpaired *t*-test. Linear and nonlinear regression analyses were used to evaluate associations between serum IgG concentration 24 hours after birth (continuous independent variable) and measures of growth performance (continuous dependent variables) of each group. Calculations were performed by using a statistical software package (GraphPad Prism version 4.01 for Windows, GraphPad Software Inc, San Diego, Calif.).

**RESULTS AND CONCLUSIONS** - Table 1 shows serum IgG levels, body weight at birth and after 30 days and MDG from day 0-30 in calves fed milk replacer (Group 1) or allowed to nurse the dam (Group 2).

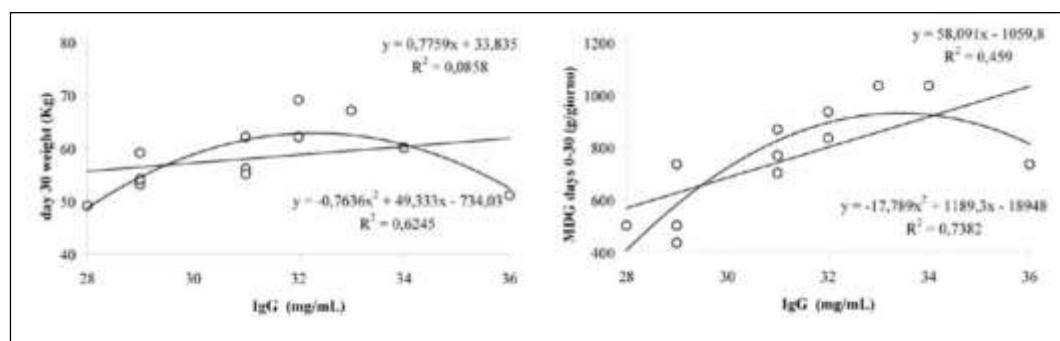
Table 1. Serum IgG concentration at 24 hours, birth weight, day-30 weight, and Mean Daily Gain (MDG) from birth to day 30 in buffalo calves fed milk replacer (Group 1) or allowed to nurse the dam (Group 2).

day		IgG (mg/ml)		Body weight (Kg)		MDG (g/day)	
		0	30	0	30	0-30	0-30
Group 1	33,2 $\pm$ 5,1	34,3 $\pm$ 5,1	52,7 $\pm$ 5,4		611,1 $\pm$ 143,8		
Group 2	31,3 $\pm$ 2,3	35,4 $\pm$ 3,9	58,1 $\pm$ 6,2*		755,6 $\pm$ 200,7		

\*  $P < 0.05$  vs group 1.

Mean day-30 weight was higher ( $p < 0.05$ ) by 5.4 kg in buffalo calves allowed to nurse the dam compared to the calves fed milk replacer. MDG was also higher in calves allowed to nurse the dam but was statistically non-significant. No significant association was detected between birth weight and serum IgG concentration 24 hours after birth in buffalo calves fed milk replacer. As depicted in figure 1, no significant association was detected between serum IgG concentration 24 hours after birth and measures of growth performance in buffalo calves fed milk replacer.

Figure 1. Scatterplot of birth weight versus serum IgG concentration 24 hours after birth in 12 healthy buffalo calves allowed to nurse the dam. The solid line represents the best fit for the data, as determined by means of simple linear regression.



Significant quadratic associations were detected between serum IgG concentration 24 hours after birth and day-30 weight ( $P < 0.05$ ;  $R^2 = 0.62$ ) and between serum IgG concentration 24 hours after birth and MDG from birth to day 30 ( $P < 0.01$ ;  $R^2 = 0.74$ ) in buffalo calves allowed to nurse the dam. The quadratic models were screened and accepted because these models resulted in  $R^2$  values significantly ( $P < 0.01$ ) higher from values obtained with the simple linear models.

Results indicated that the two groups had similar levels of IgG, birth weight, and MDG whereas a significant increase of day-30 weight was detected for calves allowed to nurse the dam compared to those fed milk replacer, suggesting a faster weight gain due to postcolostrum feeding. No significant association was detected between birth weight and serum IgG concentration 24 hours after birth in buffalo calves fed milk replacer. In the group allowed to nurse the dam, significant quadratic associations were detected between serum IgG concentration 24 hours after birth and day-30 weight and between serum IgG concentration 24 hours after birth and MDG from birth to day. In the group allowed to nurse the dam, coefficients of determination indicated that the variation attributable to serum IgG concentration 24 hours after parturition accounted on average for 62% and 74%, respectively, of the total variation in day-30 weight and the MDG. These results suggest that passive transfer status, determined as serum IgG concentration 24 hours after birth, is a significant source of variation in growth performance during the first month of life when buffalo calves nursed the dam. Further, the quadratic effect of passive transfer status on the measures of prewea-

ning growth performance of buffalo calves allowed to nurse the dam also indicated that improving serum IgG concentration within the first 24 hours after parturition may enhance the calf growth until a threshold serum IgG concentration is achieved, which seems to be concentrated in the highest passive transfer strata. The differences between the two groups underline the importance of postcolostral feeding. The significant increase of growth performance of buffalo calves allowed to nurse the dam may be due to the presence of nonimmunoglobulin factors in post-120 hours feeding (colostrum/milk) that may influence the growth. Colostrum is rich in antibodies, lymphocytes, cytokines, acute-phase proteins, hormones (growth factors), vitamins, minerals, and enzymes (Britti *et al.*, 2005). Considerable research effort has been directed in recent years at determining the relationships between development of neonatal calves and various growth factors, such as insulin-like growth factor-I and growth hormone (Odle *et al.*, 1996). Many of these nonimmunoglobulin factors in colostrum/milk might have interacted in conjunction with IgG concentration or acted directly to influence the growth response or to advance the immune and metabolic systems of the buffalo calves allowed to nurse the dam. Conversely, such nonimmunoglobulin factors could be inactivated in the milk replacer. Our results suggest that some of these factors may be still present in milk and absorbed after 120 hours of life thus affecting calf growth and, consequently, the relationship between passive transfer and weight gain. Our results indicated that passive transfer status, determined as serum IgG concentration 24 hours after birth, is a significant source of variation in growth performance when buffalo calves nursed the dam. Moreover, maximizing passive transfer of immunity by allowing buffalo calves to nurse the dam increased the growth performance during the first month of life.

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