

*Original Research***Effect of Passive Transfer of Immunity on Growth and Health of Buffalo Calves****I. Kwatra, S. T. Singh<sup>1</sup>, S. Sharma, K. Gupta<sup>2</sup> and S. S. Randhawa**

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**Abstract**

The present study was planned to evaluate the effect of passive transfer of immunity on immune status, growth and health of buffalo calves during the first 3 months of life. Twenty one normally born buffalo calves were randomly selected and serum IgG concentrations at 24-48 hrs of life were noted for all the calves. 5 out of 21 calves were found to have serum IgG concentration < 10g/L and thus suffered from FPT. Calves from FPT group had significantly higher severity of illness as compared to normal calves. Ig index was a significantly higher in case of FPT calves. Average daily weight gain was also significantly lower in the FPT group showing the direct effect of passive transfer of immunity on growth and health status of calves.

**Key words:** Buffalo Calves, Colostrum, Growth, Health, IgG, Passive Transfer of Immunity**How to cite:** Kwatra, I., Singh, S. T., Sharma, S., Gupta, K. & Randhawa, S. S. (2019). Effect of Passive Transfer of Immunity on Growth and Health of Buffalo Calves. International Journal of Livestock Research, 9(10), 107-112. doi: 10.5455/ijlr.20190810061155**Introduction**

Bovine calves are immune naive at birth because there is no trans-placental transfer of immunoglobulins (Ig) in them. Therefore, timely transfer of sufficient quantity of Ig is essential for the future health and survival of calves. This can be achieved by providing adequate amount of colostrum during first few days of life. Colostrum contains far much higher (several hundred fold) levels of immunoglobulins (Ig) (Walzem *et al.*, 2002) than ordinary bovine milk (Korhonen *et al.*, 1995) that can bind and neutralize pathogens in the GIT. Successful passive transfer requires ingestion of adequate Ig mass by the calf and absorption of Ig across the intestinal epithelium. However, sometimes due to various reasons like ingestion of less quantity or poor quality of colostrum, delay in colostrum feeding or improper intestinal absorption of

colostrum, calves are not able to acquire the adequate immunity causing a condition known as failure of passive transfer of immunity (FPT).

Serum IgG concentrations of less than 10 g/L after colostrum intake are used to describe FPT in calves (NAHMS USDA, 1993; Pare *et al.*, 1993; Rea *et al.*, 1996). The calves with FPT tend to have increased susceptibility to alimentary and respiratory tract infections leading to risk of death in the first few weeks of life and lower growth rate in the survived calves (Robison *et al.*, 1988; Wells *et al.*, 1996; Donovan *et al.*, 1998). Not receiving enough colostrum shortly after birth may affect a calf's long term health status and put them at greater risk of disease and mortality (Godden, 2008). The diarrhoea caused due to compromised health of the calf may further result in impaired gut function, depressed appetite and delayed reticulo-rumen development (Davis and Drackley, 1998). The FPT may also have long-term implications on productivity, such as reduced average daily body weight gain affecting age at first calving, decreased first and second lactation milk production and increased culling rate during the first lactation (DeNise *et al.*, 1989; Faber *et al.*, 2005).

Few studies had addressed the question of FPT, as measured by serum IgG concentration on the health and performance outcomes in dairy calves during the pre-weaning period. In a study in crossbreed calves, passive transfer status 24 hours after parturition was found to have an indirect effect on ADG and weaning weight because of the effect of FPT on calf morbidity rate (Wittum and Perino, 1995). Similarly, in buffalo calves a study has indicated that passive transfer status, determined as serum Ig concentration 24 hours after birth, is a significant source of variation in growth performance (Mastellone *et al.*, 2011).

The lack of similar data in buffalo calves is critical because of the effect of FPT and colostrum management strategies on calf morbidity rate (Lombardi *et al.*, 2001). Therefore, the objective of the study was to evaluate the effect of passive transfer of immunity on immune status, growth and health of buffalo calves during the first 3 months of life.

## Materials and Methods

Twenty-one normally born buffalo calves from the institutional dairy farm, GADVASU, Ludhiana, Punjab were selected. Calves were weaned at birth and handfed adequate quantity (~ 10 % of body weight) of good quality colostrum (>50g of IgG /L) through within 24 hrs of birth. Calves were assessed for vitality at time of birth. Blood samples were collected before colostrum feeding, at 24-48 hours and 21-28 days of life.

Collected samples were analysed for serum IgG concentrations by enzyme-linked immunosorbent assay (ELISA), using Bovine immunoglobulin ELISA kit (BioX Diagnostics). Based on the serum IgG

concentrations at 24-48 h of age, the calves were divided into 2 groups i.e. Normal calves (serum IgG  $\geq$  10 g/L) and FPT calves (serum IgG  $<$  10 g/L). The calves were monitored for any event of illness, severity of illness and days for recovery during the first three months of age. Calves were weighed at birth, 30 days and 90 days of age. Average daily gain was calculated for 30 days and 90 days of age. Ig index was also calculated as -

$$Ig\ Index = \frac{Serum\ Ig\ Concentrations\ in\ third\ to\ fourth\ week}{Serum\ Ig\ Concentrations\ in\ the\ 24 - 48\ h\ of\ life}$$

## Results and Discussion

Overall 10 out of 21 calves suffered from the diarrhoea in first 90 days. Occurrence of diarrhoea was 43.75 percent (7/16) in normal calves and 60.00 percent (3/5) in FPT calves. The severity of illness was significantly higher ( $p < 0.05$ ) in the FPT calves as compared to normal calves. However, there was no significant difference ( $p < 0.05$ ) in recovery days and the age of onset of disease in both the groups. The early days of calves' life are the most critical, in which calves suffer from highest morbidity and mortality. Previous studies had shown that the calves with FPT tend to have increased susceptibility to alimentary and respiratory tract infections leading to risk of death in the first weeks of life and lower growth rate in the survived calves (Donovan *et al.*, 1998; Raboisson *et al.*, 2016). Longer duration of illness in FPT calves, due to severe disease condition is directly related to the cost of veterinary services and medicine, while inversely related to the growth and survivability of the calves. Out of 5 cases in the FPT calves, there was 1 mortality (20.00%). However, there was no mortality in normal calves. Margerison and Downey (2005) had considered FPT as the greatest risk factor for calf health contributing 39 - 50 per cent of the mortality in preweaned calves. In previous studies, Priestley *et al.* (2013) had linked the mortality with the lower level of serum IgG concentration at 24-48 hrs. The mortality in FPT group in this study can be due to lower level of serum IgG concentration. Average daily weight gain was significantly higher in the normal calves as compared to FPT calves until 30 days. However, there was no significant difference in average daily weight gain between two groups at 90 days of life. The results in this study are similar to the previous studies in which higher ADG was linked with the higher serum IgG concentrations at 24-48 hrs of life (Raboisson *et al.*, 2016). Although other studies have shown no relation between ADG and serum IgG concentrations at 24-48 hrs of life (Dewell *et al.*, 2006). The difference in the average daily body weight gain in buffalo calves was significant at 30 day of life, as these calves became morbid at an early age and thus could not achieve optimum growth. The poor health status of buffalo and cattle calves with serum IgG concentration below 10 g/L as seen through significantly higher severity of illness, slightly earlier disease onset and longer duration in treatment, affects the calves feeding and feed conversion efficiency and

consequently growth. Such, calves might have delayed sexual maturity, which affects the future production and reproductive efficiency. The Ig index is considered as a good measure of calves' post-colostral humoral immunity against the microbial threat present. Thus, it is a useful index for predicting future health of calves. The index was calculated as a quotient of the serum immunoglobulin concentrations in the third to fourth week of calves' lives divided by the serum immunoglobulin concentrations in the 24-48 h of life (Nikolajczuk *et al.*, 1994). Ig index of the FPT calves ( $2.20 \pm 0.74$ ) was significantly higher than the normal calves ( $0.92 \pm 0.05$ ) The significantly higher Ig index in the FPT calves indicated poor future health of the calves, due to inadequate colostral immunoglobulin absorption. The higher index was achieved due to comparatively higher IgG concentration at 21-28 d than those at 24-48 h, thus indicating stimulation of active immune reaction to early infection caused by inadequate protection by colostral immunoglobulins.

**Table 1:** Health and growth of normal and FPT calves in the first 90 days of life (Mean  $\pm$  S.E.)

Parameter	Normal (serum IgG $\geq$ 10 g/L) (n=16)	FPT (serum IgG < 10 g/L) (n=5)
Serum IgG at 24-48 hrs (g/L)	14.15 $\pm$ 0.65 <sup>a</sup> (10.31-18.19)	4.41 $\pm$ 1.22 <sup>b</sup> (2.72-9.25)
Occurrence of disease/diarrhoea (Morbidity) (%)	43.75 <sup>a</sup>	60.00 <sup>a</sup>
Age at disease onset	7.63 $\pm$ 0.51 <sup>a</sup> (2-10)	7.20 $\pm$ 1.24 <sup>a</sup> (3-10)
Severity of Illness	3.25 $\pm$ 0.39 <sup>a</sup> (1-6)	5.00 $\pm$ 1.76 <sup>b</sup> (1-11)
Recovery (in days)	5.06 $\pm$ 0.32 <sup>a</sup> (3-8)	5.75 $\pm$ 0.48 <sup>a</sup> (5-7)
Mortality (%)	0	20 (1/5)
Ig Index	0.92 $\pm$ 0.05 <sup>a</sup> (0.48-1.25)	2.20 $\pm$ 0.74 <sup>b</sup> (0.85-4.85)
ADG till 30 days (Kg/day)	0.38 $\pm$ 0.01 <sup>a</sup> (0.27-0.47)	0.32 $\pm$ 0.01 <sup>b</sup> (0.30-0.37)
ADG till 90 days (Kg/day)	0.39 $\pm$ 0.01 <sup>a</sup> (0.33-0.47)	0.38 $\pm$ 0.01 <sup>a</sup> (0.34-0.43)

Values with at least one common superscript (a,b) in a row do not differ significantly ( $p < 0.05$ ).

Values in the parenthesis indicate range.

### Conclusion

In the present study, it can be concluded that failure of passive transfer of immunity (FPT) directly effects the health of calf within 90 days of life as the occurrence of diarrhoea and the severity of illness was significantly higher in the FPT calves as compared to normal calves. Moreover, lower average daily weight

gain and higher Ig index in FPT calves indicated poor future health of the calves, due to inadequate colostral immunoglobulin absorption.

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