MANAGEMENT SYSTEMS AND FAILURE OF PASSIVE TRANSFER OF MATERNAL *IGG* ANTIBODIES IN NEWBORN CALVES

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Abstract

There is a controversy to the range of serum immunoglobulin G (IgG) values in newborn calves, classified either as a failure of passive transfer (FPT) or as a partial failure (PFPT) of maternal antibodies after colostrum feeding.

For the present investigations under field conditions in Germany and at three farms in the USA, FPT was defined as IgG levels < 4 mg/ml serum and PFPT as levels between 4 and 8 mg IgG/ml serum; sampled > 24 hours after first colostrum intake.

Taking our defined levels for FPT and PFPT, 37.3% resp. 48.0% from 123 resp. 198 calves which got colostrum via bucket showed FTP and 39.7% resp. 37.9% showed PFPT under field conditions in Germany. Only 23.0% and 14.1% of these calves received sufficient maternal antibodies (> 8 mg IgG/ml serum) from colostrum. The mean IgG levels were 5.9 mg/ml resp. 4.9 mg/ml serum.

At 23 German "Bioland" farms with special management conditions, 29 calves were separated from their dams immediately after birth and colostrum was fed via bucket, an additional 40 calves were allowed to freely suckle their dams. The bucket fed calves had a mean serum IgG level of 12.7 mg/ml (13.8% FPT, 24.2% PFPT) and suckled calves one of 23.7 mg/ml (2.5% FPT, 5.0% PFPT).

In the USA (California), 94 calves on three typical dairies were fed colostrum with esophageal tube feeder. Holstein Friesian calves received 3.8 l within the first 2 hours of life, Jersey calves received 1.9 l within the first 4 hours of life. The mean serum IgG concentration was 22.6 mg/ml. Only 2.1% of the calves showed FPT or PFPT, respectively.

In conclusion, feeding large amounts of colostrum via esophageal tube feeder results in high serum IgG concentrations in newborn calves. Equivalent IgG levels can be achieved if calves can suckle theirs dams. Feeding colostrum to calves via bucket leads to significant lower postcolostral serum IgG concentrations with a high share of FPT or PFPT.

INTRODUCTION

Diarrhoea and respiratory diseases are still the leading causes of losses of newborn calves. Because calves are born nearly agammaglobulinemic, adequate passive immunity from maternal immunoglobulin (Ig) transfer is necessary to achieve prevention to infectious diseases. Immunoglobulin G (IgG) is the predominant Ig in bovine colostrum. There is a controversy to the range of serum IgG values in newborn calves, classified either as a failure of passive transfer (FPT) or as a partial failure (PFPT) of maternal antibodies after colostrum feeding.

The purpose of the study was to investigate the IgG status of newborn calves in different calf-raising management systems.

MATERIALS AND METHODS

For the present investigations under field conditions in Germany and at three farms in the USA, FPT was defined as IgG levels < 4 mg/ml serum and PFPT as levels between 4 and 8 mg IgG/ml serum.

Blood samples were collected from all calves within the first 24 to 48 hours of life. Serum IgG levels were measured with a specific bovine IgG ELISA (Erhard et al., 1995).

At different farms in the south part of Germany, 123 resp. 198 calves were fed via bucket. At 23 German "Bioland" farms with special management conditions, 29 calves were separated from their dams immediately after birth and colostrum was fed via bucket, an additional 40 calves were allowed to freely suckle their dams.

In the USA (California), 94 calves at three typical dairies were fed colostrum with an esophageal tube feeder. Holstein Friesian calves received 3.8 l within the first 2 hours of life (farm I and II), Jersey calves received 1.9 l within the first 4 hours of life (farm III).

RESULTS AND DISCUSSION

Especially under field conditions (ERHARD et al. 1995; KLINGENBERG, 1996; ERHARD et al. 1997), newborn German calves fed by bucket did not receive adequate passive immunity via colostrum due to the mean IgG levels of 6 to 10 mg/ml serum. Several factors could cause the disparity of FPT including different ranges of the definition of FPT, different test systems with unequal standards, different times of first colostrum feeding after birth, different management systems to feed calves (bucket, dam, esophageal feeder, etc.), different IgG concentrations in the colostrum and also the amount of colostrum fed. Maybe even various breeds and different ages of the animals.

Figure 1. *Serum IgG concentrations of newborn calves after colostrum intake*

MORRIS et al. (1985) and STONEHAM et al. (1991) diagnosed FPT as < 4 mg IgG/ml foal serum and PFTP ranging from 4 to 8 mg IgG/ml foal serum. LEBLANC et al. (1990) suggested that 8 mg IgG/ml is a more desirable level. However, the amount of IgG transferred from colostrum is just as important as the spectrum of antibodies present (BROWN, 1991). Most studies showed that there was a reduction in the incidence of FPT/PFTP which are associated with severe diseases when intake of colostrum IgG is maximised by similar management practices.

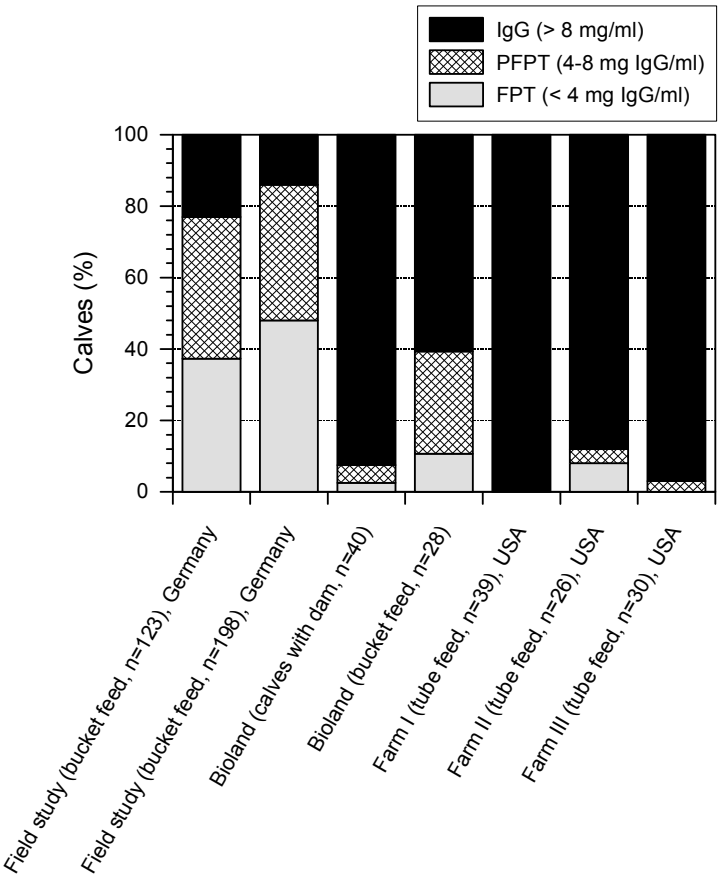

Figure 2. *Failure of passive transfer of maternal antibodies in newborn calves.*

The mean serum IgG levels after colostrum intake under field conditions in Germany were 5.9 mg/ml resp. 4.9 mg/ml serum (figure 1). Taking our defined levels for FPT and PFPT, 37.3% resp. 48.0% from 123 resp. 198 calves which got colostrum via bucket showed FTP and 39.7% resp. 37.9% showed PFPT. Only 23.0% and 14.1% of these calves received sufficient maternal antibodies (> 8 mg IgG/ml serum) from colostrum (figure 2).

The bucket fed calves at the German "Bioland" farms had a mean serum IgG level of 12.7 mg/ml (13.8% FPT, 24.2% PFPT) and suckled calves one of 23.7 mg/ml (2.5% FPT, 5.0% PFPT). The results are shown in figure 1 and 2. Serum IgG concentration of bucket fed calves correlated positively with the amount of colostrum fed the first two meals. There was also a positive relation

between the serum IgG concentration on day 2 to the IgG concentration of the first colostrum and to the total amount of IgG with the first feeding.

In the USA the mean serum IgG concentration of the calves fed via esophageal tube was 22.6 mg/ml. Only 2.1% of the calves showed FPT or PFPT, respectively. The results of the three farms are shown in figure 1 and 2.

Considering the three feeding systems, the IgG concentration on the second day of life did not show any breed differences.

In conclusion, feeding large amounts of colostrum via esophageal feeder results in high serum IgG concentrations in newborn calves. Equivalent IgG levels can be achieved if calves can suckle theirs dams. Feeding colostrum to calves via bucket leads under field conditions to significant lower postcolostral serum IgG concentrations with a high level of FPT or PFPT.

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