ASPECTS OF THE SURVIVAL AND WELFARE OF NEONATAL CALVES:

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ABSTRACT

Neonatal calves form the basis of all dairy and beef herds. There are many factors that influence calf survival and welfare and therefore the economic viability of the farm. This thesis examines four factors that have the potential to affect the survival and welfare of neonatal calves.

1. Induction of premature parturition in dairy cows results in the birth of calves that have a higher mortality rate than those born at full-term. The mortality rate of these calves decreases as their gestational age approaches full-term. The aims of the study described in chapter two were to assess the physical and physiological state of calves born at varying gestational ages. Sixty-eight induced calves that were born up to five weeks prematurely were examined and the following observations and measurements were recorded: body weight, crown rump length, rectal temperature, the number of deciduous incisors erupted and palpable, breathing rate, heart rate, gum colour, hoof membranes, serum gamma glutamyl transferase activity and a general assessment of coordination. It was found that calves born prematurely had lighter body weights, shorter crown rump lengths, lower rectal temperatures, fewer deciduous incisor teeth erupted and that they breathe more slowly. It was concluded that welfare of calves born more than 3 weeks prematurely (<259 days gestational age) were more likely to die or become ill because of a reduced ability to maintain their body temperature and difficulty breathing and feeding effectively.

2. Although many premature calves die on the farm a few are kept for rearing and the remainder are sent for slaughter. While the calves remain on the farm their welfare and survival depends on them being fed colostrum or milk at appropriate volumes and intervals. Calves that are sent for slaughter may go without food for up to 30 hours. Although the metabolic responses of full-term calves to feeding and fasting have been examined those of premature calves have not. In chapter three the responses of premature calves to different feeding frequencies (100-120 ml colostrum /kg bodyweight split into either 2 or 4 feeds of equal volume over ten hour period) and to 30

hours fasting were examined. The calves were either four or ten days old at the start of the experiment and varied in gestational age at birth. The effects of feeding frequency and fasting were assessed using the changes in plasma glucose, β-hydroxybutyrate, triglycerides, urea, total plasma protein concentration, packed cell volume and the rectal temperature.

It was found that premature calves tended to have lower plasma glucose and higher β-hydroxybutyrate concentrations than those born at full term indicating a greater dependence on lipids to provide their energetic requirements. The wide variation in these parameters was primarily determined by the gestational age of the calves at birth. Calves born further from full-term apparently depend on lipid catabolism to a greater degree.

The premature calves gained no apparent energetic advantage when fed a similar volume of milk in four feeds as compared with twice within ten hours.

There was considerable variation in the ability of the calves to tolerate 30 hours of fasting. The availability of energy in fasted calves (as indicated by plasma glucose concentration) was greater in those fed 50 ml colostrum/kg bodyweight rather than 25 ml/kg at the onset of fasting. Calves born at an earlier gestational age had a reduced ability to tolerate 30 hours without food. A decrease in rectal temperature during fasting was seen in some of the more premature calves. This period of fasting did not cause dehydration as indicated by the absence of significant increases in packed cell volume or total plasma protein concentration. The calves' postnatal age did not affect their responses to either feeding frequency or fasting.

3. The fetal membranes of twin calves often fuse where they abut resulting in varying degrees of placental vascular anastomosis. The gross anatomy of placentas from 18 twin-bearing cows, and the PCV changes of their calves between birth and 24 hours

were examined. Six classes of vascular anastomosis were identified. The extent of anastomosis varied from none, to extensive. The PCV decrease over the 24 hours following birth differed to a greater extent between twins from placentas exhibiting a high degree of anastomosis. It was concluded that these differences were likely to have been due to blood transfer within the joined placental vessels of the calves during birth.

4. The intake of colostral immunoglobulins gives neonatal calves the ability to resist disease. However, the capacity to absorb immunoglobulins decreases rapidly between 6 and 24 hours after birth. In the study described in chapter five it was found that failure of passive transfer of immunoglobulins, as indicated by low gamma glutamyl transferase activity, occurred in approximately 45% of the 74 dairy calves from which blood samples were taken. Calves that had not received colostrum were not easily distinguished from those that had on the basis of obvious physical or behavioural features.

The behaviour of 21 cows and their calves was observed between birth and the time the calves were separated from their dams. The amount of time the calves spent with their dams ranged from 74 minutes to 1492. Thirty-three percent of calves had not sucked within this time. Of those calves that did suck, 79% did so within 6 hours of their birth. There were no obvious behaviours on the part of the cows or their calves that influenced the time between birth and first sucking or the amount of time spent sucking by each calf.

Animal Ethics

Ethics approval was obtained from the Massey University Animal Ethics Committee for all experiments described in this thesis.

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