Assessing maternal behaviour and calf health in beef cattle

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Take home messages

- Calf mortality is a key issue for the northern Australian beef industry.
- Blood hormonal profiling could be a promising technique to predict maternal behaviour.
- Animal behaviour and environmental interactions can be monitored using wireless sensor systems.

Calf mortality continues to be a key issue for the northern Australian beef industry, and results in significant reductions in productivity, economic profitability, as well as poor animal welfare outcomes (Burns *et al.*, 2010; Chang *et al.*, 2020).

Calf loss during the first two weeks of life alone, has been estimated to cost the northern Australian beef industry more than $54 million annually (Barnes *et al.*, 2017). Calf wastage specifically attributed to post-natal losses within 48 hours has been hard to objectively quantify due to the extensive nature of most pastoral enterprises, although losses in general between calving and weaning remain significant (Burns *et al.*, 2010, Chang *et al.*, 2020). Similar studies for the period immediately post-partum have been done in similar environments in the United States. Large scale studies in the US have demonstrated the majority of calf wastage (57.4 per cent) occurs within 24 hours of calving, with almost 75 per cent of total deaths occurring within one week of calving (Patterson *et al.*, 1987). During this period, maternal behaviour of cattle has been found to be an important determinant of neonatal survival (Veissier *et al.*, 1998). This suggests that maternal behaviour may significantly contribute to the economic losses associated with calf wastage post calving.

Maternal behaviour is genetically controlled (Michenet *et al.*, 2016), thus there is the potential to identify cattle with superior maternal behaviour to reduce calf wastage. But a key challenge associated with behavioural traits is the difficulty in measuring and quantifying them. Recording maternal behaviour on a large scale, particularly in extensive production systems is often impractical, and there is a need to explore alternative traits that are easily measured and could be used as indicators of maternal behaviour.

Blood hormonal profiles offer a promising opportunity as an alternative trait. Past studies have demonstrated the influence of prolactin during the periparturient period is a crucial determinant of maternal behaviour. Of particular interest is that high prolactin during late gestation in mammals can program an offspring's ability to become a good mother (Sairenji *et al.*, 2017).

Given that maternal behaviour is highly conserved across mammals, it is possible that a similar relationship exists in cattle, which if characterised, offers several opportunities for genetic selection for improved prolactin, or alternatively management-based interventions that ensure high prolactin levels during late gestation. Such strategies would not only improve maternal behaviour, but also mitigate losses associated with calf wastage attributable to poor maternal behaviour.

A key challenge associated with characterising behavioural traits in cattle reared in extensive production systems, is that it is often difficult to phenotype cattle for maternal behaviour. But with recent investments in automated sensing devices, social behaviour can be accurately and objectively measured.

Local research

As part of a master's thesis, research is being undertaken at the Charles Sturt University farm to characterise the relationship between periparturient blood prolactin levels and evaluate the efficacy of using blood prolactin profiles to predict maternal behaviour. Specific research objectives include:

1. Quantifying maternal behaviour in grazing cattle using automated proximity loggers.
2. Assessing the relationship of blood prolactin concentrations with maternal behaviour.
3. Assessing the influence of maternal behaviour on calf health and survival in the perinatal period.

Proximity data logger systems will be used to quantify patterns of cow-calf interaction. Proximity loggers have been widely used in domestic and wild species to study and quantify patterns of intra- and inter-species interactions relating to behavioural, ecological and evolutionary questions. They are remote monitoring devices that automatically collect animal interaction data using user-defined parameters such as detection distance and separation time. Animals are fitted with neck collars, harnesses or ear tags that record frequency and duration of contacts when tagged animals come within a pre-set distance of one another.

Thirty pregnant cows from a single sire mating have been selected from the Charles Sturt cattle herd. The cows

were of similar age, weight, body condition score and reproductive status/health.

Cows were pregnancy tested and selected at around 35-50 days gestation and run in one group under normal Charles Sturt farm management practices.

A late term pregnancy check will be conducted at about eight months of gestation, with bloods also taken for hormonal profiling. A week prior to calving, the cows will be bought into a separate calving paddock and regular blood sampling will occur.

When cows have calved, a collar with the proximity logger (SIRTRACK™) will be fitted around the neck of the cow and the calf. Blood collection (10 ml) for serum prolactin assay will take place on the day of calving, and then every fourth day until two weeks postpartum.

Cows and calves will wear the collars for two weeks post calving, with data transfer from the proximity loggers occurring every five days. Calf hydration status, blood Immunoglobulin G levels, and body weight gain will be assessed during the experimental period.

The proximity logger data will be compared with cow and calf measurements to determine if there is any probable association between the hormone 'prolactin' and cow maternal behaviour. Future work could then look at the behaviour of subsequent generations.

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Assessing the effects of heat stress on bull semen parameters; understanding that some bulls are affected more than others.

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Take home messages

- Heat affects the production of viable spermatozoa in males.
- Heat sensitive bulls that have passed a Veterinary Bull Breeding Soundness Examination (VBBSE) may not be as efficient as a breeding animal when subjected to heat stress.

The veterinary bull breeding soundness examination (VBBSE) is recommended to be carried out on breeding bulls prior to the breeding season. A VBBSE is a risk assessment on the likely infertility of a bull. Importantly, it does not aim to assess the fertility of a bull, but rather the likelihood of the bull not being infertile.

It is recommended the assessment be done at least two months prior to the mating start date. The recommendation reflects the time taken for spermatogenesis, from an 'A' type spermatogonium to a spermiated spermatozoan, being 60 days, plus about a week of epididymal maturation.