



**Effects of body condition, body weight and calf removal on
productive and reproductive characteristics of extensive beef
cattle in Mozambique**

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Abstract

The objectives of the present research were to study the factors that influence post-partum reproductive characteristics of suckling beef cows in extensive production systems in Mozambique and to develop new management strategies to improve their reproductive efficiency. The effects and interactions between post-partum BW, BCS, age and parity number on plasma concentrations of estradiol, progesterone, creatinine, urea and cortisol around oestrus and the related conception rates of *Bos indicus* cows in extensive production system were analysed as well as the minimum BCS at the beginning of breeding to maximise the subsequent conception rates. Thirty-five days prior to the breeding season cows were synchronised using Crestar. During the second oestrus after synchronisation, 18 blood samples were collected per animal for hormonal analysis, from 24 hr before oestrus to 24 hr after oestrus. The hormonal pattern of estradiol and progesterone around oestrus were similar to that observed in *Bos taurus* cows under intensive conditions. Conception rates of cows in the experimental group were 90.5%. Better results on estradiol pattern and conception rates were related to a BCS of ≥ 2.5 and it was thus concluded that the post-partum management of extensive *Bos indicus* cows should aim to achieve at least a BCS of 2.5 at the beginning of the breeding season.

Twelve-hour and 48-hr calf removal were conducted separately to evaluate their effects on conception rates of *Bos indicus* beef cows in extensive production systems and to quantify the related effects on calf-weaning weights. The 12-hr calf removal was performed from 45 days post-partum to the beginning of the breeding season, and the 48-hr calf removal was performed preceding the onset of the breeding season. It was concluded that 12-hr calf separation at night enhance the energy balance (3%), increases the conception rates (80%) and improves the calf-weaning weights, whereas 48-hr calf removal increases conception rates (76%) and does not affect calf weaning weights. Both calf removal management strategies concentrate conceptions in the early part of the breeding season and stress the importance of the effect of BCS and estradiol on conception rates in *Bos indicus* beef cows in extensive production systems.

Summary

The objectives of the present research were to study the factors that influence post-partum reproductive characteristics of suckling beef cows in extensive production systems in Mozambique and to develop new management strategies to improve their reproductive efficiency. This study was performed in three different experiments in which specific hypotheses were tested.

In Experiment 1 the objectives were: (1) to test the effects and interactions between post-partum body weight, post-partum body condition score, age and parity number on plasma concentrations of estradiol, progesterone, creatinine, urea and cortisol around oestrus and the related conception rates in *Bos indicus* cows under extensive management conditions; and (2) to establishing the minimum BCS at the beginning of the breeding season in order to maximise the subsequent conception rates.

Twenty-five peri-parturient Brahman type cows on parity ≥ 2 were randomly selected to compose the experimental group. BW and BCS were measured around partum and thereafter at monthly intervals to the beginning of the breeding season, along with the reproductive tract monitored until the cows had shown a $RTS \geq 4$. The experimental animals were kept in the herd under extensive conditions.

Thirty-five days prior to the breeding season cows were divided into two groups and synchronised for oestrus using Crestar® (implant: 3 mg Nergestomet + 2ml of crestar injection: 5 mg oestradiol valerate; 3 mg Nergestomet and 10% Benzil alcohol as preservative) per group, three days apart. Blood samples for hormonal analysis were only collected during the second oestrus after synchronisation, from 24 hr before oestrus to 24 hr after oestrus. A total of 18 samples were collected per animal at 4-hr intervals before 12 hr preceding oestrus and 12 hr after oestrus and at 2-hr intervals during the 12 hr preceding oestrus to 12 hr after oestrus. Blood samples were collected from the jugular vein into vacuum tubes containing EDTA, which were centrifuged immediately after collection and plasma stored at -20°C . Estradiol, progesterone, cortisol and urea were assayed by ADVIA Centaur assay and SYNCRON LX® systems using Chemiluminescent technology while creatinine was analysed by Cobas Molecular P, based on the method of Jaffé reaction.

Data were analysed by means of ANOVA in SPSS. At the start of the breeding season the cows were in a positive energy balance and had a BCS of 2.8 ± 0.3 . The CR of cows was 90.5% and these conceptions were concentrated in the first 21 days after the onset of the breeding season. BCS at the beginning of the breeding season correlated positively with estradiol ($r=0.12$), progesterone ($r=0.2$), creatinine ($r=0.3$) at $p < 0.05$. Negative correlations were observed between age of the cows and estradiol ($r=-0.4$) and cortisol ($r=-0.2$) and a similar trend with parity number at $p < 0.05$. Creatinine and urea were correlated ($r=0.5$) and the values for both were within the normal range. The hormonal pattern of estradiol and progesterone around oestrus were similar to that observed in *Bos taurus* cows under intensive conditions. A relative increase in cortisol concentrations was observed at the beginning of the blood sampling and then declined. Better results on estradiol pattern and conception rates were related to a BCS of ≥ 2.5 and it was thus concluded that the post-partum management of extensive *Bos indicus* cows should be performed toward achieving at least a BCS 2.5 at the beginning of the breeding season to maximise the re-conception rates.

Experiment 2 was conducted to evaluate if restricted suckling at night from 45 days post-partum increases the conception rates of *Bos indicus* beef cows in extensive production systems in sub-tropical conditions and to quantify the related effects on calf-weaning weights. Fifty-two multiparous Brahman type cows with reproductive tract scoring (RTS) ≥ 4 at 45 days post-partum were randomly assigned to two groups of 26 cows each separated into an *ad libitum* suckling group or calf no-removal group (NRG) and treatment group or calf removal group (RG). Calves in the treatment group were separated for 12 hr during the night from 45 days post-partum to the onset of the breeding season. Satisfactory classified bulls were used at the ratio of 1:20 cows for a breeding season of 90 days.

Body condition score and BW were recorded 45 days post-partum, at the start of the breeding season, and at pregnancy diagnosis that took place 60 days after the end of the breeding season. Pregnant cows were monitored throughout the gestation period. Calves were weighed at calving and weaning. Weaning weights were corrected to 205 days. BW and BCS at the onset of the breeding season was 395.8 ± 50 kg and 2.5 ± 0.3 for the RG and 410.5 ± 40 kg and 2.6 ± 0.3 for the NRG. Calving to breeding

intervals were 93 ± 17.5 days for RG group and 99 ± 22.1 days for NRG group, respectively. Calving to conception intervals differed significantly between the experimental groups (110.9 ± 10 days for RG and 132.8 ± 19 days for NRG) and a similar result was obtained for the breeding to conception intervals (17.8 ± 15 days for RG and 31.1 ± 18.9 days for NRG). Conception rates were 80% for the RG group and 59% for the NRG group, which correlated better with BW than BCS at the onset of the breeding season. Weaning weights differed significantly between control and treatment groups (149.3 ± 18 kg for RG and 134.5 ± 20 kg for NRG). From 45 days post-partum to the onset of the breeding season, cows in the RG group experienced a positive energy balance (3%) while those in the NRG had a negative energy balance (-0.1%). It was concluded that 12-hr calf separation at night increases the conception rates and improves the calf-weaning weights of *Bos indicus* beef cattle in extensive production systems under sub-tropical conditions.

The aim of **Experiment 3** was to determine if 48-hr calf removal prior to the breeding season affects (1) ovarian steroids, cortisol, urea and creatinine; (2) improves the conception rates; and (3) influence the calf-weaning weights of *Bos indicus* cattle in extensive production systems. Sixty multiparous Brahman-type cows were randomly selected in the early post-partum period and equally allocated into a calf removal group (RG) and a non-removal group (NRG). Calves from cows in the RG were removed for 48 hr prior to the breeding season and returned afterwards, whereas in the NRG the calves remained with their dams until weaning. BW and BCS of cows were recorded at the beginning of the breeding season, mid-breeding season and just after pregnancy diagnosis.

Pregnant cows were monitored throughout the gestation period and calving dates were accurately recorded. The calving season was divided into early, mid and late, corresponding conceptions occurred in the early, mid and late part of the breeding season, respectively. Calves were weighed at birth and at weaning. Weaning weights were corrected to 205 days. BW and BCS were similar throughout the experimental period. Conception rates (CR) were 76% for RG and 55% for NRG but did not differ significantly between the groups. However, differences ($p < 0.05$) between the groups were observed for conception rates in the early and late part of the breeding season. CR was correlated with CBI and BCS at the onset of the breeding season. Product-

limit survival curves Vs CCI differed significantly ($p < 0.05$) between treatment groups. It was estimated with 95% certainty that 50% of the cows in the RG would conceive within the first 19 days of the breeding season while for the NRG within the first 38 days of the breeding season. Weaning weights were 135.2 ± 22 kg for the RG and 135.5 ± 19 kg for the NRG. In the RG estradiol concentrations increased with sampling time, contrary to progesterone. Cortisol decreased with sampling time for both groups but with higher concentration in the RG. It was concluded that 48-hr calf removal prior to breeding enhances the conception rates with the majority of cows conceiving in the early part of the breeding season. It was also concluded that 48-hr calf removal increases plasma concentration of cortisol without adversely affecting reproduction and does not affect calf weaning weights of *Bos indicus* beef cattle in extensive production systems.

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List of Abbreviations

- ANOVA – Analysis of Variance
- BCI – Breeding to Conception Interval
- BCS – Body Condition Score
- Bi – *Bos indicus*
- Bt – *Bos Taurus*
- B_w – Birth weight
- BW – Body weight
- CBI – Calving to Breeding Interval
- CCI – Calving to Conception Interval
- CI – Calving Interval
- CR – Conception Rates
- C_{ww} – Corrected weaning weight
- dl – Decilitres
- DNSV- National Directorate of Veterinary Services
- FAO - Food and Agriculture Organization of the United Nations
- FSH – Follicle stimulanting hormone
- GDP – Gross Domestic Product
- GnRH – Gonadatropin Releasing Hormone
- HPO – Hypothalamus Pituitary Ovarian Axis
- IgF – Immunoglobulin F
- LH – Luteinizing Hormone
- LHRH- Luteinic Hormone Releasing Hormone
- LSmeans – Least square means
- LSU – Large Stock Unit
- mg – Milligrams
- NRG – Non-Removal Group
- PPI – Post-partum Interval
- RFAT – Rump Fat Thickness
- RG – Removal Group
- RH – Releasing Hormone
- RLUs – Relative Light Units



RTS – Reproductive Tract Score

SD – Standard Deviation

SPSS – Statistical Package for Social Science

UFAT – Subcutaneous Fat Thickness at the *longissimus dorsi*

W_a – Weaning age

W_w – Weaning weight

μl – Micro litres

μmol – Micro mole