Effect of Restricted Suckling or Temporal Weaning on Some Physiological and Behavioural Stress Parameters in Zebu Cattle (*Bos indicus*)

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ABSTRACT : This study investigated the effects of restricted suckling (RS) on some physiological and behavioural stress parameters compared to temporal weaning (TW). Twenty Brahman (*Bos indicus*) cow-calf pairs were assigned to one of two groups: Calves in the RS group were limited to suckle their dams once daily for 30 min during days 30 to 33, while calves in the TW group were removed from their dams during days 59 to 62 postpartum. Heart and respiratory rates, serum cortisol concentration and body temperature were registered in cows and calves. In addition, the number of steps was also registered in calves. All parameters were recorded 24, 48 and 72 h after the beginning of the two treatments, respectively. In TW calves, higher ($p<0.05$) cortisol concentration and number of steps were recorded in the 1st samples and 1st and 2nd observations, respectively. No difference was found in body temperature between treatments. However, respiration and heart rates differed in the 1st and 2nd observations, respectively. In general, a significant decrease ($p<0.05$) in these three parameters was observed over time. In cows, no differences were found in cortisol concentration or body temperature between treatments or with time. Heart and respiratory rates were lower ($p<0.05$) in the TW treatment only 24 h after beginning of treatment. It was concluded that (a) RS resulted in less behavioural and physiological indices of distress compared to TW in calves, although in general, differences were found only in some variables, mainly during the 1st day following start of the treatment, and there in a chance of age effects. (b) Cows were less affected than their young, regardless of the treatment applied. ***(Asian-Aust. J. Anim. Sci. 2005. Vol 18, No. 8 : 1176-1181)***

Key Words : Beef Cattle, Calf Removal, Temporal Weaning, Animal Welfare, Restricted Suckling, Zebu

INTRODUCTION

It is well known that the suckling stimulus and the presence of the calf in beef cattle are two of the most important factors affecting the duration of the post-partum anoestrus (Ahort et al., 1990; Williams, 1990).

The most common practices to reduce the calving interval and induce the resumption of ovarian activity in zebu cattle are: restricted suckling once or twice a day and temporal weaning for 48 to 72 h (Basurto et al., 1999). These techniques are applied with very variable results, in general due to: body condition of the cow, nutrition, age of the calves, length and number of suckling episodes and length and degree of separation (Quesada et al., 1981; McSweeny et al., 1993; Hoffman et al., 1996).

Nevertheless, physical separation of mother and young, interruption of milk feeding, and a change in living environment are known to result in both behavioural and physiological stress in relation to the weaning of beef calves (Lefcourt and Elsasser, 1995 and Stookey et al., 1997; Lay et al., 1998). This is in accord with Moberg (2000) who considered stress as the biological response elicited when an individual perceives a threat to his homeostasis.

In addition, the majority of research in lactation management of beef cattle has been designed to understand and manipulate postpartum effects to reduce calving intervals. However, very few experiments have been directed toward measuring the degree of stress in cows and calves during reproductive manipulations, and to our knowledge, hardly any information is available in zebu type cattle.

In consequence, the purpose of this study was to determine the extent to which restricting suckling and/or temporal separation affect behavioural and physiological indices of stress in Brahman cows and calves.

MATERIALS AND METHODS

Animals

Twenty Brahman (*Bos indicus*) cows and their crossbred (Brahman×Simmental) calves were used. Cows had between five and seven years old, with an average body condition of 2.5 in a 1-5 scale. They calved from April to May, and ranged from two to four lactations.

All calves were allowed to suckle their mothers *ad libitum* from birth until the beginning of the treatment.

Treatments

Cow-calf pairs were assigned to one of two treatments: RS (restricted suckling) and TW (temporary weaning),

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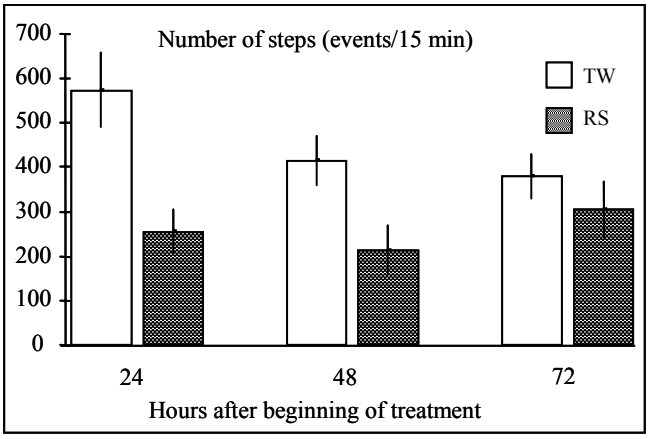

Figure 1. Mean values (±SE) of the number of steps performed during a 15 min observation period by calves at 24, 48 and 72 h after restricted suckling (black bars) or temporal weaning (white bars) were applied.

according to calving date; the cow calving first and her calf were allocated to the RS treatment; the next calving cow and calf were allocated to the TW treatment. Same procedure was used throughout the experiment. This selective random procedure was utilized to balance the age of the calves between treatments.

During the experiment all cows were grazed together on a pasture composed mainly of *Paspalum spp*. and *Axonopus spp*. (90%), and some leguminous as *Desmodium spp*. (10%). They also received mineral salt and water *at libitum*.

Calves in the TW group were isolated from their dams for 72 h starting on day 59 postpartum. During isolation, the calves remained all day in a sheltered pen where they had free access to water and a paddock. The calves were kept without physical or visual contact with their dams during the entire 72 h period.

Calves in the RS group were also separated from their dams for 72 h, starting on day 30 postpartum. Calves were allowed to suckle their dams for 30 min each morning (08:00 to 08:30). After suckling, calves were separated from their mothers and kept in a pen together with the TW calves.

Measurements

Each test was performed at 24, 48 and 72 h after calf separation, between 08:30 and 10:00. Calves were brought into an adjacent handling pen where within two min a pedometer was attached to the left front leg of each calf for 15 min. At the same time, information on body temperature and heart and respiration rates was obtained, and a blood sample taken for cortisol determination. All recordings were obtained approximately within this period to avoid variations due to ambient conditions or diurnal rhythms of metabolic variables (Lefcourt et al., 1993; Lefcourt and Adams, 1998; Lefcourt et al., 1999). In addition, heart and respiration rates were determined by the use of a stethoscope, while body temperature was measured with a rectal thermometer. The same persons took all measures on all calves and cows.

Blood samples were collected, by venipuncture of the coccygeal vein in the cows and from the jugular vein in calves, using vacutainers without a preservative. Serum samples were immediately cooled and held in ice water until separation by centrifugation within 40 min of collection. The samples were frozen until analysis. Cortisol concentrations were determined in duplicate, using commercial coated tube RIA kits (Pantex, Santa Monica, CA) according to the method of Jephcott et al. (1986). The between-assay coefficient of variation was 2.02%.

Statistical analysis

Differences between treatments for cortisol concentration and body temperature were analyzed with a t-test (Gill, 1978) using the Systat (Systat, Inc., Aurora, CO) software. The number of steps, respirations and heart beats were analyzed using the Wilcoxon-Mann-Whitney test (Siegel and Castellan, 1988).

RESULTS

More steps ($p<0.05$) were recorded in TW calves in comparison with RS treatment during the first (573.7±83.8 vs. 254.6±48.7, respectively) and second (414.4±54.6 vs. 213.8±53.8, respectively) days (Figure 1).

The highest ($p<0.05$) average serum cortisol concentration was found in TW calves, 24 h after treatment (23.36±4.9 ng/ml; Figure 2). However, this value decreased significantly to the same levels as RS on the second day (10.99±2.11 and 11.44±3.85 ng/ml for TW and RS, respectively), where as in the third sample, no differences ($p>0.05$) were found between treatments (Figure 2).

No difference was found in body temperature between treatments, even though a significant decrease was observed between the 1st and 2nd, and the 2nd and 3rd samples in the TW calves (39.6±0.14, 39.38±0.08 and 39.16°C for 1st, 2nd and 3rd samples, respectively; Figure 2).

A significant decrease over time was also observed for heart rate in both treatments (Figure 2). However, a difference between treatments was found only in the 2nd day samples (127.6±7.3 and 105.2±6.8 beats per min for TW and RS, respectively).

Calves in the RS treatment showed a higher respiration rate (44.4±1.73 respirations/min) than those in TW (37.8± 2.5 respirations/min), 24 h after beginning of the treatment, decreasing to TW levels on the 2nd day (33.2±2.2 and 36.7± 2.6 respirations/min for RS and TW calves, respectively) whereas in the third sample no differences were found between treatments (Figure 2).

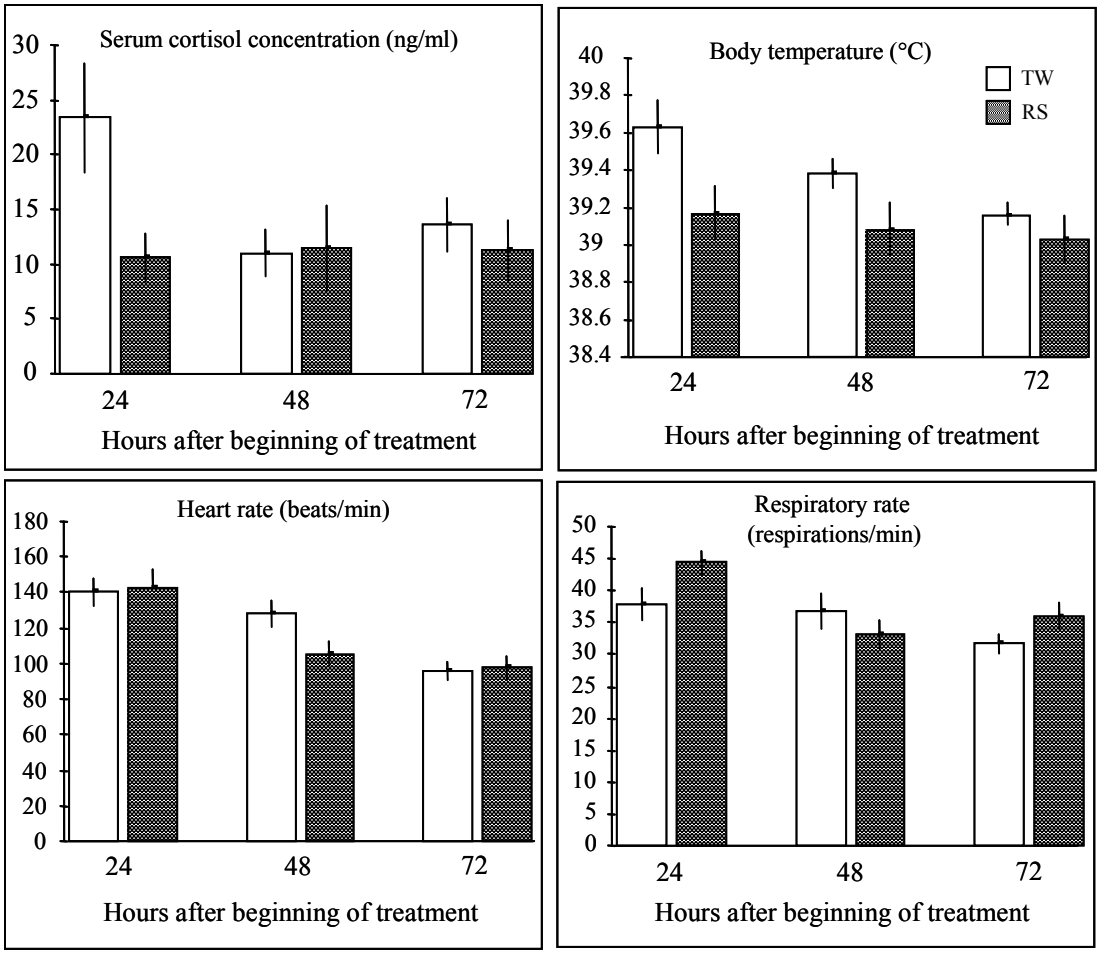

Figure 2. Mean values (±SE) of serum cortisol concentration, body temperature, heart rate and respiratory rate measured in calves at 24, 48 and 72 h after restricted suckling (black bars) or temporal weaning (white bars) were applied.

In cows, no differences were found in serum cortisol concentrations and body temperature between treatments or over time (Figure 3). Between treatments, TW displayed lower ($p<0.05$) heart and respiratory rates than RS cows 24 h after separation (46.9±4.3 vs. 67.2±3.81 beats/min and 20.8±0.76 vs. 29.2±3.53 respirations/min for TW and RS, respectively; Figure 3).

DISCUSSION

The physiological and behavioural indices of stress in ruminants include blood hormone concentrations (e.g. cortisol); heart rate, breathing (rate and depth), body temperature and locomotion (Mellor et al., 2000). However, changes in cortisol concentration appear to be particularly useful as an index of acute stress, as the activity of the hypothalamic-pituitary-adrenocortical system (HPA) increases, in response to both emotional and physical experiences.

Physiological research has supported the hypothesis that weaning and separation represents a stressful experience for both mother and young (Lefcourt and Elsasser, 1995; Uvnäs-Moberg et al., 2001).

In the present study, calves in the RS treatment displayed lower levels of serum cortisol concentration 24 h after the beginning of the treatment in comparison with those in the TW treatment, suggesting that suckling or social contact may reduce anxiety. These findings are in agreement with Stookey et al. (1997) who showed that the well-being of newly weaned calves was improved if allowed some social contact with their dams at weaning. Furthermore, according to a number of investigators (Ugarte and Preston, 1972; Álvarez et al., 1980; Knowles and Edwards, 1983), RS increases growth rate of the calf, milk yield and saleable milk of the cow, compared with no suckling. The former due perhaps because the sensory nerves of the oral mucosa of the calves are activated when the calf is suckling, leading to an increase in oxytocyn secretion that induce an anti-stress and growth-promoting effect (Das et al., 1999; Krohn, 1999; Johansson, 2003).

It is important to apply lactation management actions after parturition to resume ovarian activity as soon as

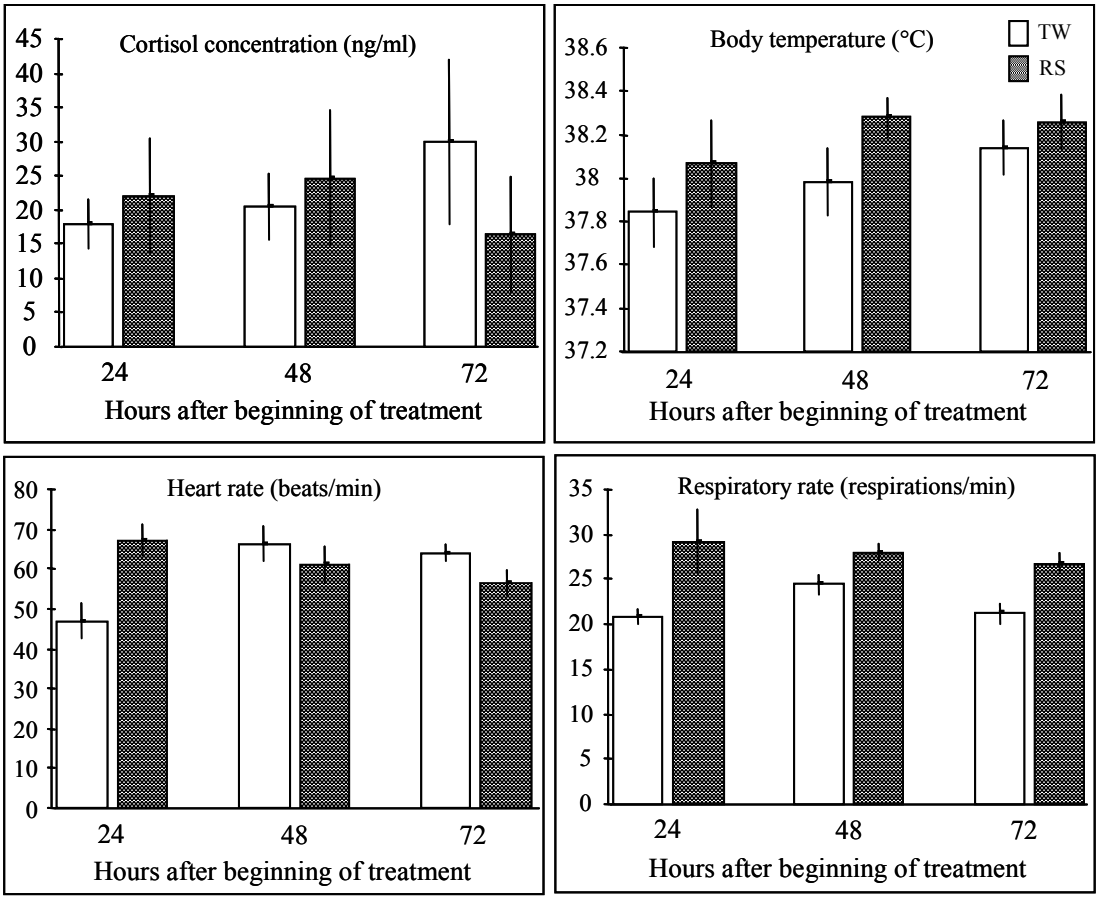

Figure 3. Mean values (±SE) of serum cortisol concentration, body temperature, heart rate and respiratory rate measured in cows at 24, 48 and 72 h after restricted suckling (black bars) or temporal weaning (white bars) were applied.

possible (Williams, 1990). However, in the present experiment calves in the TW treatment were about 20 days older than those in the RS treatment, because they need to be more developed in order to digest some solid food during the complete separation. This older age may also give them better chances to cope with stress better. Nevertheless, during their treatment they had to deal with the motivation to establish contact with their dams as in the RS treatment, but in addition they suffered an abrupt change of their suckling pattern, affecting food intake. These factors may have additive effects, and might be the reason why higher serum cortisol concentrations were found in this group.

Price et al. (2003) found higher neutrophile/lymphocyte ratios in abruptly weaned beef calves compared to gradually weaned calves. In other ruminants, quantitative age-related differences have been found in cortisol responses to stressful inducing practices (Kent et al., 1993). However, as with between-species differences in cortisol distress responses, these age effects are difficult to interpret because of the potential for differences in the operational dynamics of inputs to and outputs from the HPA axis (Mellor and Murray, 1989). Therefore, comparisons between different age cortisol concentrations should be made very cautiously. However, according to the results from the present experiment after 24 h no differences were found in cortisol concentration of calves between treatments, age differences between treatments might not be large enough to rouse an effect in hormone levels between treatments. Contrary, there was a tendency for lower cortisol concentration in calves when compared to cows.

In addition to the lack of an age effect in calves, it is also possible that the bonding between mother and young could still be strengthening at this time (30 to 60 days pospartum), especially if we consider that these practices are performed in an early stage of lactation, since the average age of natural weaning in Zebu cattle is around 10 months (Reinhardt and Reinhardt, 1981).

The only significant difference found in heart rate between treatments was observed 48 h after treatment. Price et al. (2003) found the highest vocalization rates in calves also on day 2 after weaning; concluding that motivation to contact their dams reached a peak at this time.

Calves in the RS treatment displayed less locomotion activity for two days after treatment than their TW counterparts indicating a calmer behaviour. Stookey et al.

(1997) also found fenceline-weaned calves to spend proportionately less time walking (pacing) and vocalizing and more time eating and lying down than completely separated calves, especially during the first 2 days after weaning.

Even though most variables displayed an effect in favour of RS calves, respiratory rate showed the opposite effect 24 h after treatment start. We have no clear explanation for this isolated observation.

All physiological parameters measured in the present experiment decreased over time, especially during the second day following treatment, suggesting adaptation to being separated from their dams and to the weaning environment. This is in agreement with several studies in different ruminant species that have shown that stress responses of offspring and their dams did not go beyond 72 hours after separation (Hopster et al., 1995; Stookey et al., 1997). However, it would have been useful to obtain information on variable profiles from an undisturbed control group to see if some of the differences found were related to age and/or management, perhaps masking an effect of habituation.

In cows, treatments had no effect on serum cortisol concentration supporting the findings of Hudson et al. (1975) and Hopster et al. (1995) in dairy cattle after cow-calf separation.

The significant effect in heart and respiratory rates found between treatments only 24 h after beginning of treatment, besides the lack of effect in cortisol concentration and body temperature, suggests a very early stage of stress response, because of the relative fast response of the physiological changes elicited by the sympathetic-adrenomedular system. Furthermore, another possibility is that these differences (in heart and respiratory rates) could be due to the novelty of management practices involved in the sampling and treatment process.

In general, the small physiological changes found in the present experiment, indicate that these treatments are not perceived as a potent stressor for the cow. Findings that are in accord with Hopster et al. (1995) that found that multiparous dairy cows responded only mildly immediately after their calves were removed, increasing heart rate only the first minutes after separation, while cortisol effects were not found.

It was concluded that a) even though stress variables did not changed dramatically, RS to 30 min/day during 72 h in 30 days-old calves resulted in less behavioural and physiological indices of stress compared to TW of 59 days-old calves, although in general, differences were found only after 24 h following start of treatment and b) Cows seem to be less affected by removal of their calves, regardless of the treatment applied.

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