Effect Parity on Separation Behavior of Friesian Cows: Maternal-Offspring Behavior Perspectives

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Abstract

Separation of calves from mother cows (MC) is practicing 2-3 hours after birth affecting minimum welfare of both mother and the new born calf. Aim of the present study was to determine the maternal-offspring behavior at different parities to understand the separation response among the calves and MC. Randomized complete block design was adopted. First four parities (P_1, P_2, P_3 and P_4) were considered as treatments. Blocking was done against randomly selected 5 mothers and their calves come under each parity (n=40). Behaviors were recorded by direct visual scans at 3 stages; behavior of MC at parturition, before separation (BS), after separation (AS) and behavior of calves BS and AS. Parity number (PN) was significantly ($p<0.05$) affected on MC behavior AS (24%) compared to onset of parturition (7%) and BS(4%). At parturition, only eating placenta was significantly ($p<0.05$) affected and the lowest ($0.00\pm0\%$) and the highest ($3.6\pm2\%$) showed by P_1 and P_4 respectively. Before separation, bellowing was the only significant ($p< 0.05$) behavioral difference found among the MC and the highest ($4.2\% \pm 4$) at $P_1$and the lowest (0.8 ± 1) at P_4 indicating reduction of bellowing behavior with parity advancement. Calves showed none of the behaviors affected, BS. However, AS body shaking, drinking, wagging tail and liking own body were significantly ($p<0.05$) affected in calves produced at different parities. The separation induced stress may affect for increasing the changes of behavior among both groups of animals. With parity enhancement, certain behaviors that showed maternal-offspring bond have been reduced. In conclusion, with increasing parity, certain behaviors that showed maternal-offspring bond have been reduced. It is suggested further research are needed to find the exact timing for separation in various parities with minimum welfare limitations.

Introduction

Ungulates are precocious species in which neonates are well developed and able to move independently soon after birth. They show two major categories of behavior; mother-infant relationships and tactics of predator avoidance. During the first days of life, the main behavior is the degree of association between mother and young. In all ungulates parturition is followed by a post-partum phase, lasting 1–20 hours, where intensive interaction between the mother and offspring takes place. Furthermore, protection against predation is achieved by maternal defense (Ralls *et al.* 1986).

Hormones play a major role in initiating and driving maternal behavior in all mammals (Haley *et al*, 2005). Changes in the levels of progesterone, estrogen, testosterone, prolactin and oxytocin across pregnancy and the pre-parturient period have been shown to regulate specific aspects of maternal behavior. However, when considering the bull calves they are considered as a less economic value as they do not have a gain to dairy industry. The best bull calves were kept for reproduction and the rest were sold to neighboring farms as breeding stock, draft purposes or they are slaughtered for meat production. Therefore, calves are separated from the mothers within 2-3 hours after birth.

Maternal behavior plays an important role in the success of both dairy and beef production systems. However, a strong maternal bond with the offspring may be selected against in intensive dairy production systems, as the calf is usually removed from the cow within a few hours of birth. It was hypothesized that there will be differences in maternal-offspring behavior with respect to parity number of mother cow and this relationship might be decreased with the parity advancement. Therefore, the objective of the study was to determine the maternal-offspring behavior at different parities to get an understanding of the separation time of calves from mother cow.

Materials and Methods
Experimental Site
Experiment was conducted in Bopaththalawa NLDB farm, situated in Nuwara-Eliya District of the Central Province of Sri Lanka (altitude; 1676

m., avg. annual rainfall 3150 mm and mean monthly temperature;23°C, latitude and the longitude are 6.8456° N, 80.7150° E respectively).

Animals and Experimental Protocol

In total, 20 Friesian cows and 20 calves (unsexed) produced by them were subjected to the study. Behavior suppression due to separation in relation to the parity number was compared both in mother and offspring. One parity was considered as a block and 5 milking cows were randomly selected from each of the first 4 parities. Behavior of mother cows were recorded using an ethogram (Table 1) at the time of induction of the signs of parturition and subsequently until the baby calf come out. After

parturition, behavior of mother and the newly bon calf were separately recorded continuously until separation (2 hours). After separation, behavior was observed in cows and calves by adopting Scan Sampling method (four visits per experimental unit per hour). Data were recorded for 2 consecutive hours in the morning and evening for 4 days/week within 3 months.

Data Analysis

Frequency of the behavior data as percentages were first tested for normality and were statistically analyzed using statistical analysis system (SAS, 2004). First four consecutive parities were considered as treatments and blocking was done against the parity. Within a treatment 5 mother cows and their calves were

Table 1: Ethogram used for the behavioral study of cows and calves

Activity	Description
ST	Standing (standing with no apparent movement of legs)
RE	Resting (no movement with closed eyes performing lying)
FZ	Freezing (no movement with open eyes performing erect eyes)
WK	Walking (taking one or more steps)
LY	Lying (lie down on the ground performing no perceptiblebehavior)
ET	Eating (head extended towards available feed resources and appears to be manipulating or ingesting feed)
AI	Animal Interaction (attacking the other animals in a normal or aggressive manner)
SL	Saltate (jumping locomotion, not running)
SU	Suckling (to cause or allow to take milk from the udder)
BS	Body shaking (shaking the body at medial lateral direction)
DR	Drinking (mouth contact with the water and appears to be ingested water)
RN	Running (speedily taking one or more steps)
RU	Rumination (movement of jaws in medial- lateral direction while lying)
LI	Licking (lick own body or others body)
CH	Chattering (continuous vocalization with long duration, minimum 15seconds)
WT	Wagging the tail (waging the tail in medial and lateral direction)
SF	Sniffing (investigate covertly, especially in an attempt to find out confidential or incriminating information about someone)
IS	Isolation (separation from other flock mates)
EP	Eating Placenta (eating the after birth)
LBC	Licking the Body of Calf (mother used to lick her calf using her tongue)
LBO	Licking the Body of Own (using the tongue lick the own body)
UR	Urination (discharge of urine)
FD	Fecal Discharge (discharge of faeces)
RL	Restless (animal become anxious)
HP	Hooves Preparation (removing the cartilaginous substances adhere to the hooves)
BL	Bellowing (repeatedly shouting)
OT	Any other behavior did not specify above

randomly selected. Means were separated by using Least Significant Difference (LSD) comparisons and statistical significance was reported at $p<0.05$.

Results and Discussion
Behavior of mother cow sat the time of parturition in relation to parity number
Behavior data of mother cows represented by different parities at the time of parturition are shown in Table 2. Eating placenta was the only significant ($p<0.05$) behavior at parturition which increased with the parity advancement. Inexperience and lack of mothering behavior of the cows at P_1 might have led for not eating placenta as indicated by the same behavior significantly ($p<0.05$) highest in P_4. However, there was no significant difference ($p>0.05$) between P_2 and P_3on eating placenta.

(Table 3). This may be due to the pain associated with the inexperienced first parturition. However, no any significant differences ($p>0.05$) shown by the calves for bellowing behavior either before or after separation (Table 4).

Further proving our findings, Solano *et al.* (2007) also found that vocalization is a behavioral indicator which indicates that separation is stressful. In the current study it was assessed as bellowing. Further they found that Zebu-type calves showed increased locomotion, butting, urination and vocalization and reduced grooming, lying and eating when separated by abrupt weaning at several months of age when a strong bond has formed. This behavioral response increases if both cow and the calf are kept together for several days before separation

Table 2: Behavior of mother cows at parturition in relation to different parities

Behavior#	Parity Number				P
	P_1	P_2	P_3	P_4	
Standing	2.7±2	0.9± 1	0.9± 1	0.9± 1	0.46
Freezing	0.0±0	0.9± 1	0.0±0	0.0±0	0.41
Walking	1.8± 2	0.9± 1	0.9± 1	1.8± 2	0.84
Lying	1.8±1	2.7± 3	3.6±3	3.6±3	0.54
Eating Placenta*	0.00^b±0	1.8^{ab}± 1	2.7^{ab}± 2	3.6^a±2	0.05
Body shaking	4.5±4	4.5± 4	4.5± 4	4.5± 4	-
Drinking	1.7±1	2.8±2	2.8±2	2.8±2	0.91
Licking	4.5±4	4.5±4	4.5±4	4.5±4	-
wagging the tail	0.9±1	1.8± 2	1.8± 2	1.8± 2	0.90
sniffing	4.5±4	4.5±4	4.5±4	4.5±4	-
isolation	0.0±0	0.9± 1	0.9± 1	0.9± 1	0.80
Urination	4.5±4	4.5±4	3.6±3	3.6±3	0.58
Faecal Discharge	2.7±3	3.6± 2	3.6± 4	2.7± 3	0.84
Restless	4.5±4	4.5±4	4.5±4	4.5±4	-
Bellowing	4.5±4	4.5±4	4.5±4	4.5±4	-

P_1,P_2,P_3 and P_4-parity 1, parity 2, parity3 and parity 4 respectively.
^{a,b}*Means within the raw bearing different superscripts are significantly differ.*
Average of five cows per each parity stage. * *Only significant parameter in the list*

Bellowing was the only significant ($p<0.05$) behavior among mother cows before separation of calves which has been reduced with the advancement of the parity. The highest value of bellowing was showed by P_1cows compared to other cows represented by different parities

likely because this allows more time for maternal bonding to occur. However, calves spent the most time sniffing the cow and suckling during the first 6h period after birth, while the time spent lying increased and the

Table 3: .Behavior of mother cows before and after separation of calves in relation to different parities

Behavior*	Behavior of mother cow before separation				P	Behavior of mother cow after separation				p
	P1	P2	P3	P4		P1	P2	P3	P4	
Standing	1.6±1	0.8±1	1.6±1	0.8±1	0.84	1.5±1	1.6±1	1.5±1	1.6±2	0.83
Resting	1.6±1	4.2±4	2.5±2	2.5±2	0.27	1.5^a±1	1.5^a±1	1.3^{ab}±1	1.2^b±1	0.04
Freezing	0.0±0	0.0±0	0.8±0	0.0±0	0.41	0.0±0	0.0±0	0.0±0	0.1±0	0.19
Walking	0.8±1	0.0±0	1.6±1	0.0±0	0.26	1.3±1	1.3±1	1.4±1	1.3±1	0.73
Lying	1.6±1	3.3±3	1.6±1	2.5±2	0.58	1.3±1	1.4±1	1.4±1	1.3±1	0.23
Animal Interaction	0.0±0	2.5±2	2.5±2	1.6±1	0.19	0.9^d±1	1.3^c±1	1.7^b±2	2.1^a±2	0.00
Saltation	0.0±0	0.0±0	0.0±0	0.0±0	-	0.0±0	0.0±0	0.0±0	0.6±0	0.11
Body shaking	2.5±2	0.8±0	0.8±0	1.6±1	0.54	1^a±0	0.9^{ab}±1	0.9^{ab}±1	0.8^b±0	0.07
Suckling	0.0±0	0.8±1	0.0±0	0.0±0	0.41	0.0±0	0.0±0	0.0±0	0.0±0	-
Eating	0.0±0	0.0±0	0.8±0	0.8±0	0.58	1.3±1	1.1±1	1.2±1	1.2±1	0.45
Drinking*	1.6±1	1.6±1	1.6±1	2.5±2	0.91	1.1±1	1.0±1	1.1±1	1.0±1	0.67
Licking	3.3±3	1.6±1	2.5±2	1.6±1	0.58	1.3^b±1	1.5^a±1	1.5^a±1	1.4^{ab}±1	0.03
Rumination	0.0±0	1.6±1	0.8±0	0.8±0	0.53	1.6^a±1	1.4^b±0	1.5^{ab}±1	1.5^{ab}±1	0.14
Wagging the tail	2.5±2	3.3±3	0.8±1	0.8±1	0.15	1.4±1	1.5±1	1.3±1	1.2±1	0.21
Sniffing	2.5±2	0.8±0	2.5±0	2.5±2	0.55	1.0±1	1.0±1	1.1±1	1.1±1	0.26
Isolation*	1.6±1	0.0±0	0.8±1	0.0±0	0.26	1.8^a±2	1.3^b±1	1.0^c±1	0.6^d±0	0.00
Urination	2.5±2	1.6±1	0.8±1	3.3±3	0.29	0.9±1	0.9±1	0.8±0	1.0±1	0.30
Faecal Discharge	0.8±0	0.8±0	1.6±1	1.6±1	0.84	1.1±1	1.0±1	1.1±1	1.1±1	0.81
Restless	0.8±0	0.0±0	1.6±1	0.0±0	0.26	0.2±0	0.2±0	0.1±0	0.2±0	0.39
Eating Placenta	0.8±0	1.6±1	0.8±0	0.0±0	0.53	0.0±0	0.0±0	0.0±0	0.0±0	-
Defecation	1.1±1	1.0±1	1.1±1	1.1±1	0.71	1.1±1	1.0±1	1.1±1	1.1±1	0.81
Bellowing*	4.2^a±4	3.3^{ab}±3	1.6^{bc}±1	0.8^c±1	0.03	1.4±1	1.3±1	1.3±1	1.2±1	0.69
Other	0.0±0	0.0±0	0.0±0	0.0±0	-	0.0±0	0.0±0	0.0±0	0.0±0	-

^{a,b}Means within the raw bearing different superscripts are significantly differ.

#Frequency percentage of the percentage averages of randomly selected five cows and calves per each parity stage.

* Significant parameters

number of lying bouts decreased throughout the 24 h following birth (Solano *et al.*, 2007).

Behavioral changes of both mothers and calves were higher after separation compared to before separation (Table 3 and Table 4) indicating separation had an effect on both mothers and calves. It was seen that certain behaviors that shows to express affection such as wagging tail and licking body showed significant changes after separation in calves produced in different parities. In absence of mothers, calves used to perform licking own body and it was gradually reduced with the calves produced in relation to the advancement of the parity. Before separation though bellowing was the only significantly different behavior in cows, it was changed after separation as indicated by changed behavior in resting, animal interaction, licking and isolation. Isolation and resting behaviors were significantly reduced with the advancement of the parity. Results showed that irrespective of the parity, early separation causes stressful situation to both mother and calf as behaviors related to mother-offspring bond have been shown during first few hours after delivery.

Table 4: Behavior of calves produced at different parities before and after separation

Behavior	Behavior of calves before separation				p	Behavior of calves after separation				p
	P1	P2	P3	P4		P1	P2	P3	P4	
Standing	0.0±0	0.8±0.5	0.0±0	0.0±0	0.41	1.7±1.2	1.8±1.4	1.8±1.4	1.8±1.4	0.62
Resting	1.6±1.3	2.5±2.1	2.5±2.1	0.0±0	0.19	1.3±1.1	1.3±1.1	1.3±1.1	1.4±1.1	0.87
Freezing	0.0±0	0.0±0	0.0±0	0.8±0.4	0.41	0.2±0.1	0.2±0.1	0.2±0.1	0.1±0.0	0.35
Walking	1.6±1.4	0.8±0.5	0.8±0.4	0.0±0	0.53	1.2±1.1	1.1±0.9	1.2±0.9	1.2±0.8	0.85
Lying	1.6±1.2	3.3±3.1	3.3±3.0	1.6±1.4	0.39	1.5±1.3	1.5±1.3	1.4±1.2	1.4±1.2	0.64
Animal Interaction	2.5±2.1	1.6±1.4	3.3±3.1	0.8±0.4	0.29	1.0±0.8	0.9±0.8	0.9±0.8	1.1±1.0	0.44
Saltation	0.0±0	0.0±0	0.0±0	0.8±0.5	0.41	0.0±0	0.0±0	0.0±0	0.0±0	0.39
Body shaking*	1.6±1.3	0.8±0.5	0.8±0.4	0.8±0.4	0.87	0.9[b]±0.8	0.9[b]±0.7	0.9[b]±0.7	1.0[a]±0.7	0.05
Suckling	2.5±2.1	3.3±3.1	3.3±3.1	0.8±0.5	0.19	0.9±0.4	1.0±0.9	1.1±0.8	1.0±0.8	0.88
Eating	0.0±0	0.0±0	0.0±0	0.0±0	-	1.3±1.1	1.2±1.0	1.2±1.0	1.3±1.1	0.71
Drinking	0.0±0	0.0±0	0.0±0	0.0±0	-	1.3[a]±1.2	1.2[ab]±1.1	1.3[ab]±1.0	1.1[b]±0.9	0.01
Licking	2.5±2.1	2.5±2.3	3.3±3.1	2.5±2.2	0.90	1.5±1.1	1.6±1.3	1.6±1.3	1.5±1.1	0.51
Rumination	0.0±0	0.0±0	0.0±0	0.0±0	-	-	-	-	-	-
Wagging the tail*	0.8±0.5	1.6±1.2	0.8±0.5	1.6±1.3	0.84	1.4[ab]±0.9	1.3[b]±1.0	1.4[ab]±1.0	1.5[a]±1.2	0.01
Sniffing	1.6±1.3	0.8±0.5	1.6±1.2	0.8±0.5	0.84	1.1±1.0	1.0±0.8	0.9±0.8	1.1±0.9	0.09
Isolation	0.8±0.5	0.0±0	0.8±0.4	0.0±0	0.58	1.0±0.8	1.2±0.9	1.1±1.0	1.3±1.0	0.27
Urination	1.6±1.4	2.5±2.3	2.5±2.3	1.6±1.2	0.87	1.0±0.8	1.0±0.8	1.1±0.8	1.0±0.8	0.46
Defication	0.0±0	0.8±0.4	0.0±0	0.0±0	0.34	1.2±0.9	1.1±1.0	1.1±1.0	1.2±1.0	0.30
Restless	0.8±0.7	1.6±1.3	0.0±0	1.6±1.4	0.45	0.8±0.5	0.6±0.2	0.6±0.2	0.8±0.5	0.43
Licking body own*	0.0±0	0.0±0	0.0±0	0.0±0	-	1.8[a]±1.3	1.6[ab]±1.4	1.4[b]±1.1	1.3[b]±1.1	0.01
Bellowing	1.6±1.2	1.6±1.3	1.6±1.3	2.5±2.1	0.91	1.3±1.0	1.4±1.2	1.5±1.1	1.4±1.1	0.53
Other	1.6±1.2	0.0±0	0.0±0	0.0±0	0.08	0.0±0	0.0±0	0.0±0	0.0±0	-

[a,b] Means within the raw bearing different superscripts are significantly differ.

[#] Frequency percentage of the percentage averages of calves produced by randomly selected 5 cows per each parity stage.

*Significant parameters

Conclusion

Separation of calves from mother cows causes stressful condition to both mother cow and calf as indicated by changed behaviour in both mother cow and the calf. Behaviors that indicated mother-offspring bond have been reduced with the parity advancement. Therefore separation time can be reduced with the parity advances and further research are suggested to investigate exact separation time with respect to different parities.

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Activate Wind

Assessment of Ground Water Quality Influences on Human Health and Agriculture: A Case Study in Pakistan

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Abstract

Groundwater contamination through toxic metal/elements has a considerable impact on public health and agriculture in the areas of Pakistan, where majority of the people rely on groundwater for drinking purposes and agriculture. Taking this situation into consideration, groundwater samples from 119 public places in flood affected areas of the district Sanghar of Pakistan were investigated for physico-chemical parameters, essential metals and trace elements (color, odor, pH, electrical conductivity (EC), turbidity, chloride (Cl), alkalinity, nitrate (NO_3), sulphate (SO_4), TDS, calcium (Ca), magnesium (Mg), sodium (Na) and potassium (K)), trace elements (iron (Fe), zinc (Zn) and arsenic (As)). Chemical analysis data showed that 55, 41, 08, 33, 32, 16, 55 and 46% water samples were having high concentration of Hardness, Ca, Mg, Cl, Na, K, SO_4 and TDS respectively. Trace elements such as Fe, As and Zn were also high in 49, 26 and 9 % samples respectively. Due to the elevated levels of above parameters, it can be concluded that groundwater could pose a serious threat to the health of the people residing the area and the agricultural soils.