

Research report

Display of Social and Sexual Behaviour of Calves

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Prefactory note

Within the study to become a veterinarian at the Faculty of Veterinary Medicine at the University of Utrecht all students have to fulfill a research project of three months in their fifth year. This paper is the final report of my research project. This was carried out for the department of farm animal health of the faculty of Veterinary Medicine at the University of Utrecht The Netherlands in cooperation with the faculty of Veterinary Medicine at Montevideo, Uruguay and the National Agricultural Research Institute (INIA) region Tacuarembó, Uruguay.

Research was executed to learn more about the importance of social interactions of calves of 4 to 6 months with adult members of the herd, other than their own mother, with regard to sexual development and reproductive behaviour. All the practical work was executed upon four groups of 10 Hereford cattle at Glencoe, one of the experimental stations of INIA Tacuarembó, Uruguay.

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Abstract

The aim of this study was to learn more about the social needs of calves during their adolescent period under semi-natural conditions and to quantify the importance of social interactions of calves of 4 to 6 months with adult members of the herd, other than their own mother, with regard to sexual development and reproductive behaviour. 20 Hereford calves with their mothers and 2 supplement calves were selected from a group of 60 animals. All cows were multiparous and the calves were between 111 en 137 days of age (mean 128,57) at the start of the study. The 20 calves were balanced for gender but otherwise randomly assigned into four groups. In total the groups were 22 days under semi-natural conditions in Uruguay observed in the period of mid March to mid April with a scan sampling and behaviour sampling method. Male calves showed significant more feeding and resting behaviour than female calves (respectively $p=0.021$ and 0.023), but female calves showed significant more nursing behaviour ($p=0.021$). Correlations were observed between feeding and resting behaviour ($p=0.022$) and feeding and walking ($p=0.012$) Both were negative with respectively a value of $-0,510$ and $-0,551$. During behaviour sampling male calves had on average 38,05 ($n=99$) interactions and female calves have 6,75 more ($n=90$). This was a significant difference ($p=0.000$). Interactions with a calf as contact animal was significantly more observed than interactions with mother or another adult as contact animal (resp. $p=0.000$ and $p=0.927$). Calves performed more social behaviour than sexual behaviour or potentially sexual behaviour ($p=0.000$). There was no significant difference between the group nor sex, age and weight had significant influence on the type of behaviour (social, sexual, potentially sexual) performed by the calves.

Regarding only social behaviour a calf which was 1 day older than the mean age of 128,57 days had almost 1 social interaction less ($p=0.000$). Also weight had a positive correlation with number of social interactions. A calf weighing 1 kilogram more than the mean weight of 157,79 kilograms had 1.004 more interactions ($p=0.004$).

Introduction

Innovations in stock management are characterized by larger livestock numbers kept together in markedly reduced space. This requires considerable physiological and behavioural adaptations of the animals. It has been assumed that the animals could adapt to the environmental restrictions but failure to adapt is more and more recognizable in the behaviour of animals and decreases animal welfare (Arave and Albright 1981). Welfare can be defined as a state of harmony between an individual and its environment (Désiré, Boissy, Veissier 2002). Any marked deviation from this state, if perceived by the individual, results in a welfare deficit due to negative emotional experiences. Many of the current husbandry problems are not soluble by investigating nutrition, body physiology or disease control, but require investigations of the behaviour before progress can be made towards a solution. Knowledge of the behaviour of livestock under intensive husbandry systems and their 'normal' behaviour is therefore needed to assess these systems of management (Fraser and Broom 1990; Martin and Bateson 2007). The foundation of cattle behaviour can be found in the fact that they form a social group based on dominance relationships. Groups are of variable size and the maximum number in a group should be determined by the number able to form a stable social hierarchy through recognition of herd mates. Diversity within the group in sex, age and size enhance the recognition. Suggested is a minimum of three animals in a group and a maximum of 50 – 70 animals (Arave and Albright 1981; Keeling and Gonyou 2001).

Frequency of social interactions between cattle is higher among younger animals than adults. Closely related animals form strong long-term bonds, especially mother and calf bonds are very long lasting (Harris and others 2007). The social network of young calves consists first only of their mother. Then other calves become important and to some extent other adults. The first 10 days after birth cow and calf are within 15 m of each other in 61.6% of the observations. At 33 days of age of the calves the mother-young distance reaches a maximum amount of meters and then declines. Contact with non-mother cows passes in the

opposite direction, so the while the mean distance between mother and calf is smaller the distance between non-mother and calf is larger when the calf is younger (INIA).

Cattle are described as hidiers in terms of mother-young relationship after parturition, which means that the mother frequently leaves her offspring behind in some area during maintenance activities as resting, grazing or ruminating. Offspring often form a subgroup or crèche in this period and spent most of their time resting in this crèche or play. Under extensive or semi-natural range conditions calves tend to form groups from the age of 6 weeks, usually with one or two cows near them as ‘guardian’ (Hirata and others 2003; Sato, Wood-Gush, G. 1987). Allogrooming is seen more between cattle that are close in birth and are reared together (Sato, Wood-Gush, G. 1987). A high incidence of allogrooming indicate a strong social bond between the animals displaying this behaviour.

For a newborn calf there are two different kinds of problems. The first is how to survive the first period of life when it is vulnerable to predation, physical conditions and to the risk of not obtaining adequate nutrients. The second one is how to change in such a way to become an effective adult. Lack of early social experience modifies the social development of calves. Even restricted contact with unfamiliar animals reduces problems related to grouping and social interaction (Lidfors and Jensen 1988). In intensive husbandry systems for example cross-suckling ears, scrotum, prepuce, tail, udder area or navel of another calf is common in group reared calves. Some calves drink also urine from other calves.

Figure 1 comes from a research project of Bøe and Færevik 2003 and shows influencing factors on social behaviour. Also the influence of social behaviour on productivity and welfare is clear from this figure. A better understanding of calf behaviour, the development of this behaviour and the establishment and maintenance of contact between adult cows and calves can improve the environment of husbandry systems (Arave and Albright 1981; Keeling and Gonyou 2001; Lidfors and Jensen 1988; Bøe and Færevik 2003).

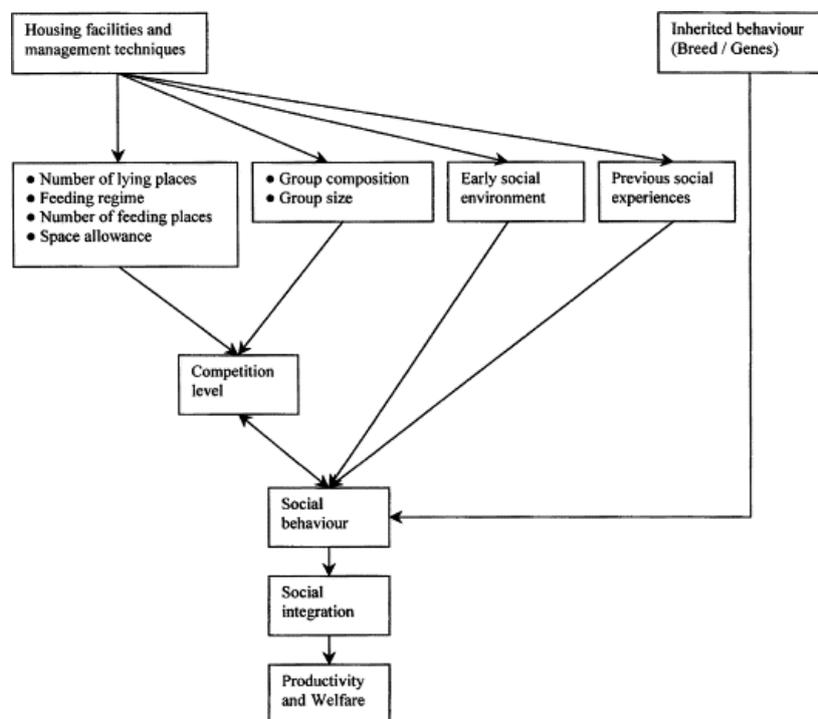


Figure 1: factors influencing social behaviour which itself has influence on productivity and welfare. (Bøe and Færevik 2003)

The aim of the present study is to learn more about the social needs of calves during their adolescent period under semi-natural conditions in order to improve the social welfare of calves reared in intensive husbandry systems and to give a different research angle in reducing the problems mainly concerned with reproduction. Do calves prefer their mother as contact animal during their adolescent period or are calves

more important? During the adolescent period around the age of 4 to 6 months, sexual behaviour is developed (Arave and Albright 1981). Reproductive behaviour is of great importance to managers of a stock unit. For example oestrus in dairy cows is detected by the farmer through assessing the behaviour. Work on mating preferences and factors affecting libido are of critical importance in the management of animals where a high proportion of successful mating is desired. Each animal whose offspring production fails or is delayed, costs the farmer money. The objective of the present study is to quantify the importance of social interactions of calves of 4 to 6 months with adult members of the herd, other than their own mother, with regard to sexual development and reproductive behaviour. Behaviours that are of special interest are sexual interactions, but all social interactions will be taken into account to get an overall idea about the social needs of calves. Questions to answer are: During which time of the day is social behaviour more expressed? Can sexual behaviour been seen at the age mentioned above?

The study was conducted at "Glencoe", one of the two experimental stations of the National Agricultural Research Institute (INIA) region Tacuarembó, Uruguay. INIA Tacuarembó has research projects on native and sown pastures; genetic (i.e. breed crosses), nutritional and management factors in livestock production systems (cattle and sheep), plant variety evaluation and crop management for warm season and cool season crops, as also in horticulture. Also production systems; seed services and regional relations are of interest. Glencoe is situated in the department of Paysandu, 130 kms. west of Tacuarembó city and has a total area of 1305 ha. The cattle are kept in an extensive husbandry system in which social interactions occur more natural compared to intensive husbandry systems.

Material and Method

For this study 20 Hereford calves with their mothers and 2 supplement or reserve calves were selected from a group of 60 animals. All cows were multiparous and the calves were between 111 en 137 days of age (mean 128,57) at the start of the study. The calves grew up under the same circumstances in this large group and were held in semi-natural conditions. The 20 calves were balanced for gender but otherwise randomly assigned to one of the four groups. Groups "Blue" and "Blanco" consisted of 3 male calves and 2 female calves. The other two groups, "Green" and "Yellow", consisted of 2 male calves and 3 female calves. Every group of 10 animals had 5,4 hectares of pasture. Water was ad libitum in an automatically filling trunk where 3 adult cows or 5 calves could drink at the same time. Every week the animals were brought into a corral for painting the numbers and controlling their health.

In total 22 days of observation was done in the period of mid March to mid April. Using binoculars a distance between the herd and the observer could be maintained of at least 70 m, to make sure the animals were not influenced by the observer.

At the second week of the study one of the cows of group "Green" with number 9 was eliminated together with her calf from the study because of an infection with actinomycosis. One of the supplement calves with his mother was added to the group and was assigned number 21 and had the same gender as the calf who was eliminated (male). Data collected of group "Green" of that day after adding the new cow and calf (number 21) were not included in the statistical analysis.

There were two types of sampling methods used in this study: scan sampling and behaviour sampling. Behaviour of interest for scan sampling was every behaviour an animal can display. Behaviour of interest for behaviour sampling was only social behaviour. In the appendix are descriptions listed of the behaviour focused on. If the behaviour is used in the scan sampling there was no distinction between social or non-social behaviour, but if the behaviour was used in the behaviour sampling, the behaviour was always social although the description of the behaviour in the appendix is non-social.

Data were analyzed with SPSS Statistics 17.0 using the Poisson regression model and correlations for the behaviour sampling data. The data obtained during scan sampling and behaviour sampling full day were analyzed with SPSS Statistics 17.0 T-test and a Pearson correlation.

Behaviour sampling full day

The first two days of observation took place from sunrise until sunset, from 07.00 am until 07.00 pm to define the hours in which the calves showed most social interactions and thus could be used for behaviour sampling. Every social interaction was recorded when the interaction was initiated by a calf or the calf was involved in the interaction with another animal.

Scan sampling

Under this method one records the activity of a group or individual at the pre-selected time intervals of 7 am until 11 am and 4 pm until 7 pm. This allows for clearly defined and structured research that gives a good representative sample of the behaviours taking place, but one does not have to be observing 24 hours a day. To compare the behaviour observed between the days a scan sampling was performed during the same moment of each day. Every time interval started with 20 minutes of scan sampling. This time includes observation of every calf and the walking time needed to get all animals in view. Calf number 9 was excluded from the T-test and the Pearson correlation, because of the outlier in percentages of the types of behaviour performed.

Behaviour sampling

Scan sampling was immediately followed by 40 minutes of behaviour sampling. Every social interaction was recorded when the interaction was initiated by a calf or a calf was involved in the interaction. If a 'B' is added to the abbreviation of the behaviour then the calf is subject of the behaviour and not the initiator. The initiator of the behaviour is then the mother, another calf or an adult. To analyze the different kinds of social behaviour 3 subgroups were made: social behaviour, sexual behaviour and behaviour that was social and could be sexual. Sexual behaviour included 'anogenital lick', 'ejaculating', 'flehmen', 'mounting' and 'tongue flick'. Mounting was only recorded as sexual behaviour if preceded by 'chin rest conspecific' or if it was displayed in a combination with other sexual behaviour. Otherwise it was assigned to social behaviour like in 'play' or in the group of behaviour that could have social or sexual function. This last group also includes the behaviour 'anogenital sniffing', 'chin rest conspecific' and 'mounting'. (for explanation behaviour see appendix) With the number of social interactions seen per hour during the full day sampling (figure 1), the hours between 07.00 and 11.00 am and 04.00 and 07.00 pm were the best hours to observe the animals for the most social interactions.

Results

General results

At the second week of the study the animals were weighed. Weight of the calves varied between 107 and 205 kg (mean 157,79).

Behaviour sampling full day

During the two days of observation the most social interactions were observed in the morning between 9 and 10 am. During that hour 74 social interactions were observed involving a calf. During the first four hours after sunrise and the last two hours before sunset calves were more socially active. More interactions and more different kind of actions were seen during these moments. For example play behaviour is only seen in the first three morning hours and from 3 pm the calves start again with a little bit play (see figure 1). From 4pm the results showed more social interactions between animals compared to the hours from 12am until 4pm. From 1 until 2 pm there was a rise in interactions and from 3 till 4pm the calves also showed more interactions. From 2 until 3pm the number of social interactions was 17, the lowest for these days. Only interactions that appeared more than 10 times during a day were individually noted in the chart. Other social behaviour was grouped under one term "Other".

There were no significant differences in frequencies of behaviour between the hours, neither was there a significant difference between the 4 groups of calves.

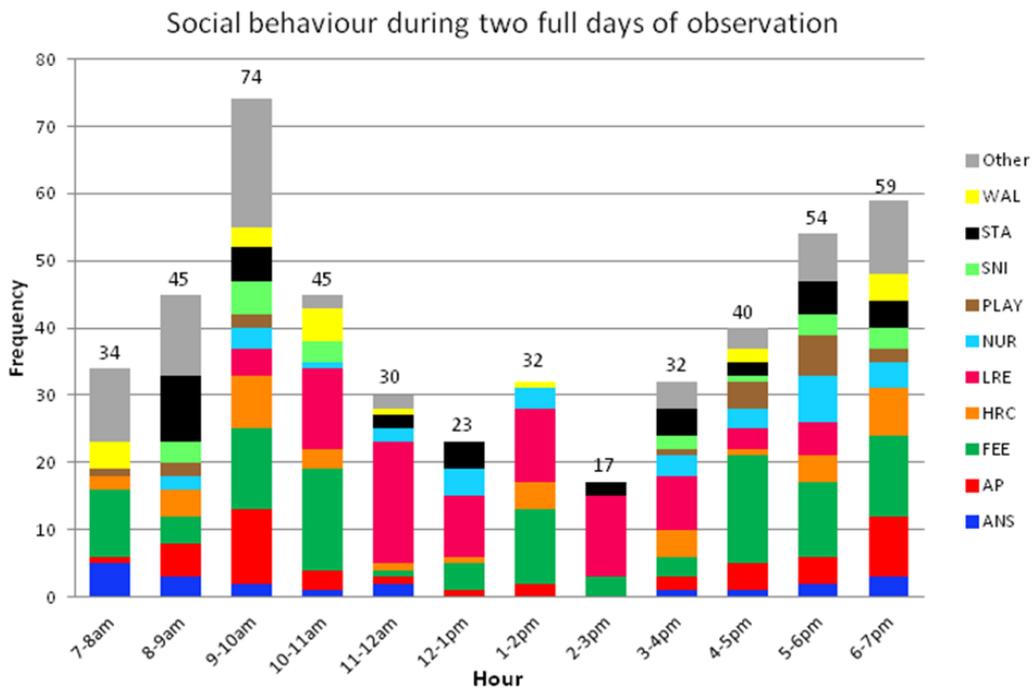


Figure 2: Calves showed more social behaviour during the first four hours and the last three hours of an observation day than during midday. Midday behaviour consisted mostly of resting behaviour in groups. The numbers above the bars represent the total number of two days observing social interactions for that specific hour.

Scan sampling

2499 observations were performed for the scan sampling. These observations include 126 observations which are not valid and cover the time between the exclusion of cow and calf number 9 because of an actinomyces infection of the cow and the introduction of cow and calf number 21. The male calves contribute 52,4 % of these and females 47,6 %.

During the morning hours, from 7 am until 11 am, 59,0 % of the time the behaviour consisted of feeding. During the evening hours from 4 pm until 7 pm this was 65,7%. 2,2% of their time in the morning calves were nursing, 6,7% ruminating, 19,9% resting (LRE and SLE) and 5,8 and 2,8% of their time they were respectively standing and walking. During the afternoon and evening they were resting 12,0 % of their time, 2,7% consisted of ruminating and 5,2% and 5,8% of their time they were respectively standing and walking. Also in these hours they were 4,9 % of their time nursing. (Figure 3, 4 and 5)

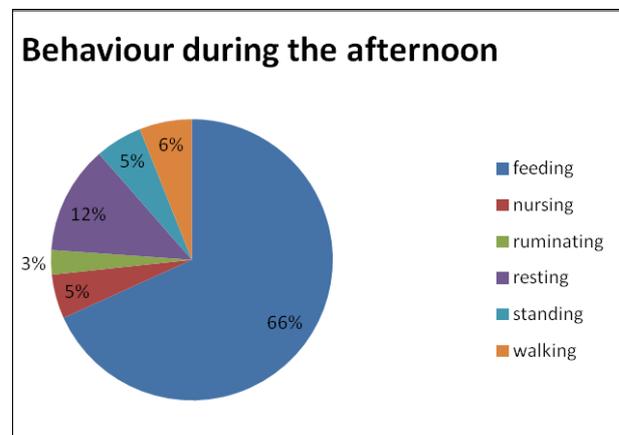
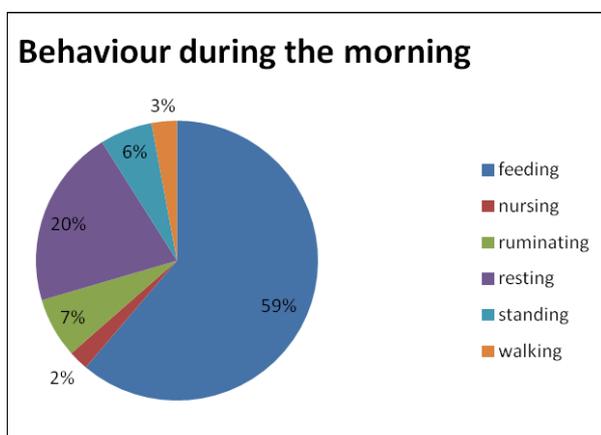


Figure 3 and 4: Percentage of time spent at the 6 most observed behaviours during scan sampling. Left pie chart shows the behaviour during the morning period (7-11am), right pie during afternoon period (4-7pm)

Table 1 shows more specific observation results and presents how individual calves classify their time. Several behaviour types are mentioned together with gender and weight of the calves. It shows that except for calf number 9 every calf spent most of the time feeding, followed by resting. Male calves showed significant more feeding and resting behaviour than female calves (respectively $p=0.021$ and 0.023), but female calves showed significant more nursing behaviour ($p=0.021$).

Correlations existed between feeding and resting behaviour ($p=0.022$) and feeding and walking ($p=0.012$) Both are negative with respectively a value of $-0,510$ and $-0,551$. No correlations are found between the other behaviours of table 1 ('other' not included) and weight also has no significant correlation.

Gender	Calf	Feeding	Resting	Ruminating	Drinking	Walking	Standing	Other	Weight (kg)	Age at start of study
0	1	53,8%	24,4%	3,4%	4,2%	4,2%	4,2%	5,8%	149	128 days
0	4	63,0%	16,8%	2,5%	3,4%	5,0%	5,9%	3,4%	148	128 days
0	5	61,3%	19,3%	2,5%	1,7%	3,4%	10,1%	1,7%	205	134 days
0	9	25,0%	0,0%	0,0%	12,5%	25,0%	37,5%	0,0%	146	135 days
0	10	65,5%	15,1%	4,2%	2,5%	4,2%	5,0%	3,5%	170,5	128 days
0	11	67,2%	15,1%	4,2%	0,8%	1,7%	6,7%	4,3%	152	111 days
0	12	65,5%	12,6%	6,7%	5,0%	3,4%	3,4%	3,4%	190,5	129 days
0	17	68,1%	16,8%	5,9%	3,4%	0,8%	3,4%	1,6%	177	136 days
0	19	60,5%	24,4%	5,9%	4,2%	0,8%	2,5%	1,7%	153,5	125 days
0	20	73,1%	13,4%	1,7%	3,4%	2,5%	3,4%	2,5%	125	130 days
0	21	64,4%	13,4%	8,7%	3,8%	3,8%	1,9%	4,0%	174	135 days
1	2	58,8%	17,6%	5,9%	3,4%	7,6%	4,2%	2,5%	161	125 days
1	3	56,3%	16,8%	5,9%	4,2%	8,4%	5,9%	2,5%	153	122 days
1	6	55,5%	14,3%	5,9%	6,7%	5,9%	6,7%	5,0%	165	137 days
1	7	61,3%	16,0%	5,0%	3,4%	5,0%	7,6%	1,7%	107	127 days
1	8	64,7%	13,4%	4,2%	3,4%	2,5%	7,6%	4,2%	128,5	124 days
1	13	58,8%	17,7%	5,9%	4,2%	2,5%	7,6%	3,3%	186	138 days
1	14	56,3%	14,2%	6,7%	3,4%	6,7%	5,0%	7,7%	173	138 days
1	15	59,7%	19,3%	5,0%	1,7%	2,5%	7,6%	4,2%	146,5	124 days
1	16	60,5%	16,8%	5,0%	3,4%	5,0%	5,9%	3,4%	156	118 days
1	18	67,2%	12,6%	5,0%	1,7%	4,2%	3,4%	5,9%	147	128 days
Mean		60,3%	15,7%	4,8%	3,8%	5,0%	6,9%	3,4%	157,79	128,57

Table 1: Result of scan sampling behaviour. Numbers under the column calf are the numbers to recognize the individual. For every individual calf is listed the gender; 0 is male, 1 is female, weight and percentages of most performed behaviour. The term 'other' refers to every behaviour possible not mentioned already in this table.

Behaviour observed per observation hour

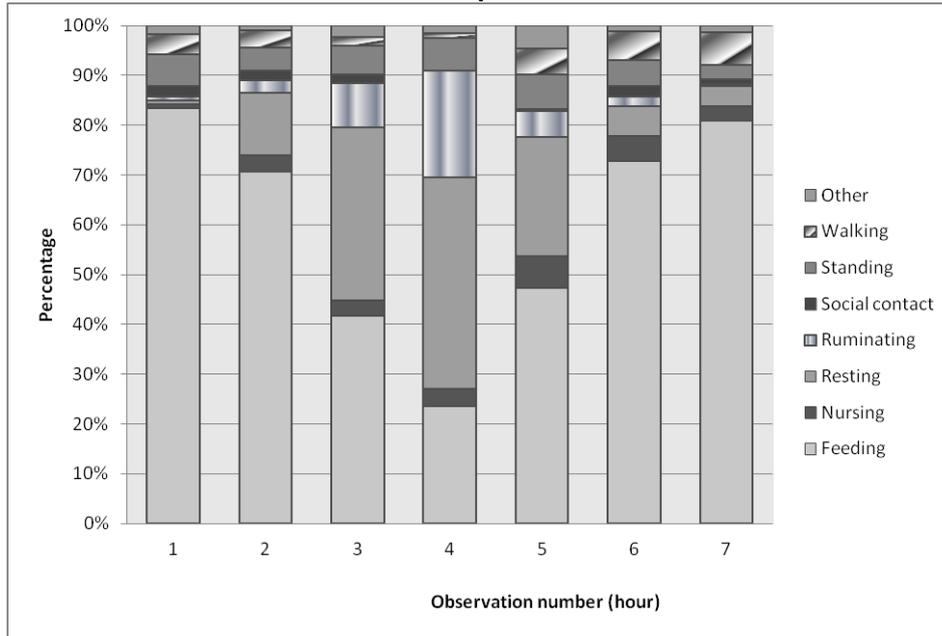


Figure 5: Behaviour observed during the day shown per observation hour. Observation number 1 is behaviour between 7 and 8 am. Observation number 4 around 11 and 12 am. Number 5 is the first hour of observation during the afternoon and 7 the last one until sunset. Behaviour is grouped in 7 topics where 'social contact' includes social behaviour not already included in the other topics like play, sniffing and grooming. The topic 'other' is all other behaviour not already mentioned.

Behaviour sampling

During behaviour sampling 7799 social interactions were observed. Male calves had on average 38,05(71,04) interactions and female calves had 44.80(78,57). Maximum number of interactions for the males were 319 and females 308 ($p = 0.000$).

The highest number of interactions was seen when an interaction involves a calf as contact animal. This was on average 74,11(111,70). There were on average 25,14(37,19) interactions with their own mother and there were on average 24,54(36,97) interactions with an adult cow other than the mother. The difference between the number of interactions of a calf with contact animal mother and a calf with contact animal adult was significant ($p=0.000$), but there was no significant difference in amount of interactions between mother and adult ($p=0.927$) (figure 6).

Calves perform more social behaviour than sexual behaviour or potentially sexual behaviour. The average number of interactions were respectively 123,03(81,74), 0,06(0,30) and 0,70(1,12). The performance of sexual behaviour was at maximum 2,23% of the total number of interactions – which gave a number of 173,92 interactions. The number of interactions between all types of behaviour were significantly different ($p=0.000$) (figure 7). There was no significant difference between the group nor sex, age and weight had significant influence on the type of behaviour performed by the calves.

Resting behaviour was in 85% of the cases in the form of a crèche of at least 3 animals. An adult cow was part of the crèche during 80% of the resting cases.

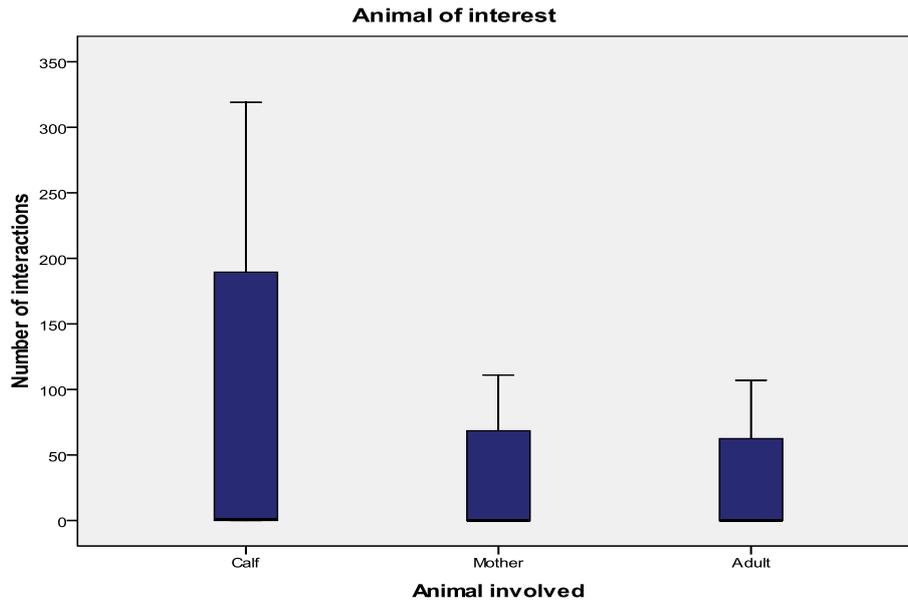


Figure 6: The number of different contact animals of the calves during social interaction

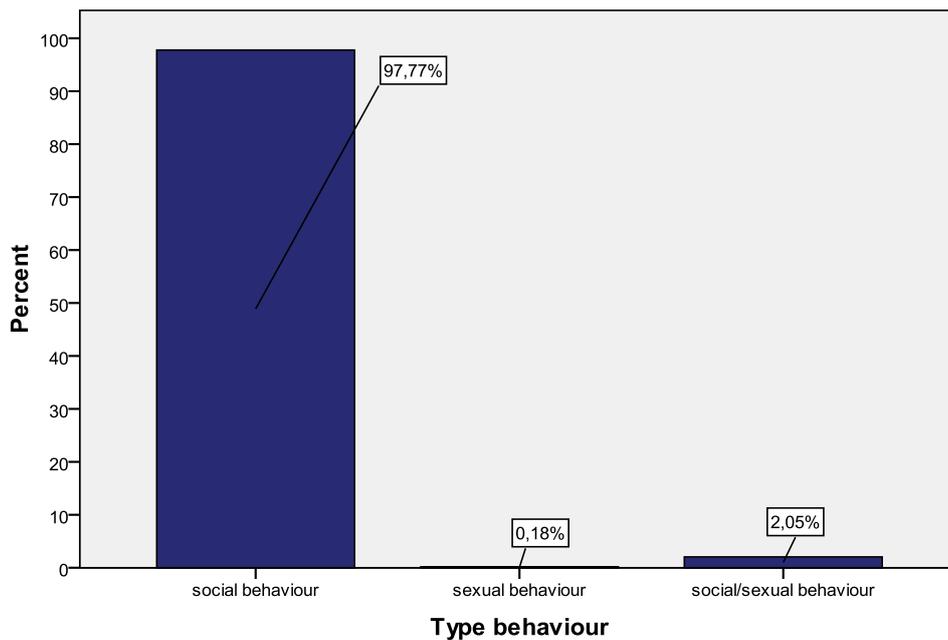


Figure 7: Percentage of types of behaviour performed by the calves

Results from the Poisson analysis showed that a female calf with mean age and weight had 235 social interactions. Sexual behaviour was $5,16 \times 10^{-4}$ less and for behaviour that was potentially sexual this was $5,7 \times 10^{-3}$ times less compared to social behaviour. Male calves with mean age and weight had 204 social interactions. The variables type of behaviour performed, sex and contact animal had significant influence on the number of interactions (all $p=0.000$)(Table 2). Also age and weight influences were significant. A calf which was 1 day older than the mean age of 128,57 days had almost 1 social interaction less ($p=0.000$). Weight had a positive correlation with number of interactions. A calf weighing 1 kilogram more than the mean weight of 157,79 kilograms had 1.004 more interactions ($p=0.004$). Most interactions were performed with a calf as contact animal which is illustrated in figure 6 and table 2.

Poisson Analysis - Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	5.463	.0187	5.427	5.500	85090.600	1	.000	235.904	227.401	244.725
Sexual behaviour	-7.569	.5001	-8.550	-6.589	229.058	1	.000	.001	.000	.001
Sexual / social behaviour	-5.171	.1512	-5.468	-4.875	1170.061	1	.000	.006	.004	.008
Social behaviour	0 ^a	.	.	.	.	.	.	1	.	.
Male calf	-.147	.0230	-.192	-.102	40.548	1	.000	.864	.825	.903
Female calf	0 ^a	.	.	.	.	.	.	1	.	.
Mother as contact animal	-1.081	.0291	-1.138	-1.024	1382.087	1	.000	.339	.320	.359
Adult as contact animal	-1.105	.0293	-1.163	-1.048	1418.836	1	.000	.331	.313	.351
Calf as contact animal	0 ^a	.	.	.	.	.	.	1	.	.
Mean weight	.004	.0006	.003	.005	46.535	1	.000	1.004	1.003	1.005
Mean age	-.007	.0019	-.011	-.004	15.525	1	.000	.993	.989	.996
(Scale)	1 ^b									

Table 2: Poisson analysis with dependent variable the number of interactions. Social behaviour, female calf and contact animal 'calf' are set as reference.

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

Discussion

In semi-wild conditions the mother and other calves of the same age are the most important animals to interact with for a young calf. In the present study, there was more contact with other calves, which is consistent with the report of Sato et al. (1987). This report also mentions the fact that 3-6 month old calves were found to generally prefer a calf as nearest neighbour, but if the nearest calf was 30 m away it was not selected as nearest neighbour. Forming a crèche is defined by Sato et al. as a group of calves which are lying within 20 m of each other, which was seen in this research during early morning and early afternoon. Before lying down some calves show sniffing behaviour at a nearby animal. Some calves are more sociable than others and may exhibit more sniffing behaviour than the other calves, which seems to be related with sex, breed and the original group. Calves within 20 m of one another behave synchronously. (Sato, Wood-Gush, G. 1987) and this can be confirmed with this research project. Distance measurements were in this research project not possible, but it is a recommendation for future projects to include these. Sato (1987) also found big crèches of calves tend to be formed in early morning with a nearest neighbour distance changing with age and crèche size also increases with age, except during the age of 5 and 6 months. 5 and 6 month old calves space themselves out, suggesting that crèche behaviour begins to stop at these ages. When they do come together in a group, the group size is smaller. At this age play behaviour also decreases and the calves begin to show more adult behaviour such as affiliative and aggressive behaviour. Throughout the first 6 months of age female calves spent more time within 50 m of their mothers than male calves did and mother and calf spent more time together when the weaning weight was low compared to calves with a higher weaning weight. Male calves significantly directed more sniffing towards cows other than the mother than female calves. Sniffing towards the mother did not differ between the genders. Also, maximal distance tends to be smaller with a younger calf, however, this can be correlated with the lower weight of the calves (Lidfors and Jensen 1988; Hirata and others 2003). In the present study only the fact that female calves had more interactions than male calves was observed. The age of the calves used in the present study and the use of a beef breed which has a slower development than dairy breeds could have an effect in the observed results, but there is no scientific research done on this topic so far.

Calves were more active and more socially active as well during the morning and afternoon. They showed more different kinds of behaviour and are more interactive with each other. During the morning hours 6,7% of the time was more spent with feeding compared to the evening hours. During the morning the time feeding declined and resting time increased. The same effect was seen for ruminating and nursing. During the afternoon, resting and ruminating increased during the observation period. Prominent in the afternoon was the amount of calves which were nursing. From 4 to 6 pm this is 6,3 and 5,0 %, which was much more than 3,9 % from 6 to 7 pm and the percentages in the morning. Most of the social interactions took place between the periods of crèche forming in early morning and afternoon and the four main grazing periods: shortly prior to sunrise, mid-morning, early afternoon and near dusk. From 11 am until 4 pm the herd was mostly resting, probably due to the high temperatures (>28°C). Only Arave and Albright (1981) described briefly the natural behaviour of cattle and the influence of the environment on the behaviour. Most articles nowadays are focused on lying behaviour and lameness or lying behaviour and cubicle bedding. Hours spent by cattle grazing was 4-14 hours. The period of rumination can be 4-9 hours and the hours spent lying down are usually in the 9-12 hour range. (Swanson and Harris 1958). At 112 days of age calves spend about 6,3 hours ruminating. This is 26 % of a day. The researchers observed for 24 hours once every 2 weeks (Swanson and Harris 1958). The calves in the present study project spent 60 % of their time feeding and only 5 % of their time ruminating. This can be explained by the fact the observation periods were picked due to the high amount of social interactions. In this period of time there is less time to feed or ruminate. In the hours before 7 am, between 11 am and 4 pm and after 7 pm there was no observer watching the herd so in this period is possible the calves were more ruminating. The number of grazing periods are similar between bulls and cows, but males which are not castrated are disturbed more easily. They spend less time grazing (at least during the day), ruminating and show shorter grazing bouts (during summer). Bulls apparently make use of the time thus made available for elaborate social

interactions and have more idling, more fighting, and more sexual activity than cows. (Fraser and Broom 1990; Arave and Albright 1981) Also Færevik et al. (2007) found bull calves significantly mount more than females, but this includes also play behaviour. Female calves were more socially active than male calves. Both sexes preferred a calf as contact animal. For example, a female calf had 80 interactions less with her mother than with other calves. For contact with an adult this was a difference of an extra 2 interactions less than with her mother. Since female calves were more socially active than male calves and the performance of sexual behaviour was at maximum 2,23% of the total number of interactions – which gave a low number of 173,92 interactions compared to the number of social interactions – wherefore the results of this research differ from the results of the research of these authors. This is possibly due to diversity in social, sexual and seasonal environments (Arave and Albright 1981; Martin and Bateson 2007). The observed sexual interactions or potentially sexual interactions were low during this study. Effect on reproductive development is difficult to determine. For this, a longitudinal study is necessary over a longer period of time. Also effect of older males in the herd has to be determined with respect to reproductive development and observing reproductive behaviour. Social cues, often in the form of priming pheromones from the male, can retard or enhance the rate of sexual development in a variety of mammals (Vandenbergh 1989). The complex interactions between the social environment and reproduction have been explored most thoroughly in the house mouse. A urinary pheromone produced by females in a group inhibits sexual development, and a urinary pheromone from adult males accelerates onset of puberty in juvenile females. These priming pheromones apparently are detected by the vomeronasal organ and induce the changes in ovarian function via changes in the hypothalamic-pituitary system. Pheromones in the wool, wax and urine of a ram are also sufficient to stimulate ewes to ovulate and the mere presence of the boar at time of insemination of the sow improves sperm transport and ovulation. In bovine reproduction, the role of pheromones is not as clearly defined as in sheep, goats and boars, but it is known that the presence of a vasectomised bull hastens the onset of puberty in heifers and also early resumption of ovarian activity in cattle following parturition. A study with crossbred beef heifers with exposure to bull urine showed a larger percentage of urine treated heifers reached puberty during research period than of water treated heifers. Heifers in both treatments had the same pregnancy rate, but urine-treated heifers calved significantly earlier than watertreated heifers (Rekwot and others 2001; Vandenbergh 1989)(Arave and Albright 1981) described cows exposed to a teaser bull came earlier into estrus with a greater intensity of estrus than unexposed cows. These results suggest that a priming pheromone possibly is present in the urine of bulls that affects sexual development.

Conclusion

Animals use their freedom to move and to interact, both with their environment and with one another, as one of the most important ways in which they adapt themselves to the conditions in which they live. Under intensive husbandry system conditions, normal behaviour of cattle is submitted to restrictions which influence the health in the broadest sense of its meaning. The restrictions begin with accommodating a newborn calf and ends with the end of life as (dairy) cow. To keep or improve the level of production of dairy cattle in these days and to crack a major problem like reproduction, it is import to look beyond the familiar solutions to problems by adjusting nutrition, body physiology or disease control and to try to improve welfare by providing their social needs. Calves need contact with their mother, calves of their own age and other adults. The extent to which depends on the age of the calves. Calves of 4 to 6 months mostly have contact with other calves. Interactions are social with now and then a sexual interaction and these are more displayed during morning hours (7-11am) and afternoon hours (4-7pm). With respect to development of reproductive behaviour and influence of this behaviour on reproductive physiology more studies and more intensive studies are needed.

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Appendix

If the behaviour is used in the scan sampling, it isn't social or non-social behaviour, but if the behaviour is used in the behaviour sampling, the behaviour is always social.

If a 'B' is added to the abbreviation of the behaviour, then the calf is subject of the behaviour and not the initiator. The initiator of the behaviour is then always the mother or an adult.

ANL Ano-genital lick: An animal slowly moves its tongue in and out and makes contact with the ano-genital region of a conspecific. Sexual function

ANS Ano-genital sniff: One animal moves its nose to the ano-genital region of another and inhales. Social or sexual function

AP Approaching: Directional movement that decreases the distance between two or more animals and provides an opportunity for the animals to interact. Social or agonistic behaviour

BC Bite conspecific: An animal briefly grips part of another individual with its teeth. Agonistic behaviour

BU Bunting: An upward movement of a calf's head prior to or during nursing that results in its forehead or bridge of its nose making contact with the udder or abdomen of a female.

CHA Chase: One individual runs after another. Agonistic or play behaviour

CHP Chin press: One animal puts its chin on the back of another individual (usually while it is standing) and exerts a strong downward pressure. This usually causes the second animal to depart. Agonistic behaviour.

CHR Chin rest conspecific: One animal lightly rests its chin on the back or shoulders of a standing conspecific. Social and sexual function. Is also part of the oestrous behaviour: testing an animal if she will be standing when mounted. It therefore precedes mounting.

CLI Clinch: pushing its muzzle between leg and udder. Often seen in fights. Ideal for combatants to rest safely by taking this position with its opponent. Agonistic behaviour

DEF Defecating: The passing of feces while in a standing position. The tail is arched and the hind legs are spread far apart just prior to voiding the fecal matter.

DEP Departing: Directional movement of one animal away from another that serves to increase the distance between them. Social function

DRI Drinking: Lapping water with the tongue to bring it into the mouth where it can be swallowed.

EJA Ejaculation: Spasmodic twitching of an erect penis that results in an expulsion of ejaculate. Sexual behaviour

FEE Feeding: Taking food items into the mouth and chewing and swallowing them. Animals typically feed while standing (or walking), but occasionally will feed while in lateral recumbency.

FEEN Feeding: See description above. Only with this behaviour the animals are feeding with nose to nose contact. Social behaviour.

FIG Fight: a threat provoked a threat in return. Fighting follows head to head followed by head to neck. Agonistic behaviour

FLE Flehmen: An animal, after sniffing the urine or ano-genital region of a conspecific, opens its mouth and raises its upper lip while slightly arching its neck. Following this sequence the animal will frequently, but not always, lick its lips. Sexual behaviour

FOL Following: One animal approaches one or more individuals, while it (they) departs. Social or agonistic behaviour

FOK Foreleg kick: An animal kicks out at a conspecific with one of its forelegs. Often the animal being kicked is in lateral recumbency. Agonistic behaviour

HAS Hard stare: One individual faces another and stares at it without moving. The head is held slightly lower than when in a typical standing position. Agonistic behaviour

HES Head shake: A rapid side-to-side movement of the head with the nuzzle pointed downwards. Typically this display is directed at another animal, and may occur while the animal is facing, or is broadside to, its opponent. Agonistic behaviour

HLK Hind leg kick: An animal kicks backwards with one hind leg.

HBU Horn butt: One animal lowers its head and jabs another animal in the body with its horns. The severity of the butt may vary from a relatively gentle shove to a powerful thrust that can cause serious injury. Agonistic behaviour

HRC Horn rub conspecific: An animal rubs the outside edge of one horn against part of the body of another individual in a non-aggressive manner. Social function

LDI Lateral display: An animal stands broadside to another animal, places his hind legs in a forward position to cause the back to arch, and lowers its head; showing its largest profile. The eyes are open wider than normal and the animal often turns slowly so that it is always presenting the flank. Agonistic behaviour; ambivalent behaviour. Most seen between males

LRE Lateral recumbency: A reclining position. The hind legs may both be under the body, or may be held away from the body. The forelegs can be folded under the sternum, or one or both may be fully extended. The head is held off the ground. Resting behaviour

LREA Behaviour as described above, only the animals lying so close to each other there is physical contact.

LC **Licking conspecific:** *Allogrooming*; An animal slowly moves its tongue in and out and makes contact with the head, horns, legs or torso of another individual. Social function.

MOU **Mounting:** One individual stands on its hind legs and positions its fore body on the back and rump of another animal while placing its forelegs on either side of the standing animal. Mounts may be male-female, male-male, or female-female. Social, sexual or agonistic behaviour

MOO **Moowing:** Vocalization. Frustration and/or stress

MUZ **Muzzle toss:** An animal points its muzzle upwards and shakes it from side-to-side.

MUZC **Muzzle-to-conspecific touch:** One animal touches another with its muzzle. Social function

NUR **Nursing:** The suckling of any of a female's teats by a calf.

PWA **Parallel walk:** Two animals locomoting in the same direction, with both animals employing a similar gait and moving at a similar speed. Social function

PAW **Paw ground:** An animal drags a front paw over the ground. This may occur only once or several times in rapid succession, and may be accompanied by snorting when the animal is very upset. Agonistic behaviour may also occur before a cow lies down. Kind of scratching the floor in order to loosen up the soil. Has thus a different function.

PLAY **Play behaviour** can include running games, playful mountings, gambolling, bucking, kicking, prancing, butting, vocalization, head shaking, goring and pawing. Play-call and Play-specific tail position can be seen.

REC **Reclining:** Kneeling on the forelegs to move from a standing position to lateral recumbency.

RET **Retreat:** withdrawal of threatened animal. Often accompanied by a submissive posture in which the head is low and directed away from the opponent. Agonistic behaviour

RIS **Rising:** Kneeling on the forelegs to move from lateral recumbency to a standing position.

RUN **Running:** An accelerated form of locomotion in which one or two hooves may be out of contact with the substrate at any given time.

RUNT Running, described as above to another animal. The running animal approaches another animal and stops in front or next to it.

SLE **Sleeping:** Lying in lateral recumbency with the eyes closed. An animal may sleep with its head up (with muzzle pointed downward), or it may rest its chin on a folded or extended foreleg. If resting its chin on a folded foreleg, typically the head is positioned so that the muzzle points towards the rear of the animal. Young calves (less than three months old) will sometimes sleep on their side, with their heads lying on the ground.

SNI **Sniff conspecific:** One animal moves its nose against another individual and inhales. Social function

SPA Sparring: Two animals drop their heads and engage their horns. This may occur without pushing, or the animals may try to vigorously shove each other backwards. Agonistic or play behaviour (= also called "butting")

STA Standing: An animal is supported by four limbs without locomotion. General activity

STAA Standing as described above, but against another animal; with physical contact.

SIP Step in place: A stepping motion without locomotion. Animals will frequently make tight circles while stepping. Could have a function as relieving nervousness (or when in pain)

SWA Swagger: One animal approaches another with a stiff-legged gait and head held lower than usual. The head may also be tilted slightly to one side. Agonistic behaviour

TAI Tail arch: An animal holds its tail away from the body.

THREAT include head shake, lateral display, butt.

THRB is a threat by another animal (mother or adult) to a calf

TOF Tongue flick: The tongue is moved in and out very rapidly. This behavior frequently occurs after an animal sniffs or licks urine. Sexual behaviour

TOG Tooth grinding: Animals occasionally grate their cheek teeth while reclining.

URI Urinating: The passing of urine while in a standing position. The hind legs are spread apart while urine is being passed.

WAL Walking: A leisurely form of coordinated quadrupedal locomotion in which all four legs are in motion. Normally only one hoof at a time is lifted off the ground.

WATCH Watching: A calf is looking to another animal.

WATB Watched by: A calf is watched by another animal and the calf is reacting on this behaviour by approaching or walking away.