

Behaviour reactions of dairy calves kept in boxes

A. Gavinelli, A. Moro, E. Canali, V. Ferrante and C. Carezzi

Istituto di Zootecnica Veterinaria, Via Celoria 10, 20133 Milan, Italy
Tel ++39-2-2369433 - Fax ++39-2-70602227

ABSTRACT: *Behaviour reactions of dairy calves kept in boxes.* Housing calves in individual boxes during the first month of life did not appear to cause any marked differences in the behaviours of lying and standing in the animals observed in this study, compared to those in a natural environment. However a lack of lying on side was observed which would suggest that, even at a very young age, the reduced size of the box can influence the use of normal lying positions, reported in the species-specific ethogram. A greater amount of feed searching occurred during the moments of greatest activity (sunrise and sunset) and close to meals probably correlated to sucking requirement of the animals. It emerged from this study that even though the calves and their living conditions were homogeneous, there were individual variations in the behavioural patterns even in the very early days of life which could be attributed to varying degrees of reactivity and therefore to the individual animal's capacity to adapt to a potential stressor such as the reduced size of its box and the effect of confinement.

KEY WORDS: calves, box, behavioural patterns, adaptation.

Introduction

Though dairy calves are often raised in a variety of housing and management systems, they are normally housed in individual boxes during the first month of life. This system appears to fulfil health requirements by avoiding the spread of disease and by allowing food rationing as in this first month of life, calves are very susceptible to infection, disorders involving the digestive tract and respiratory trouble (Steenkamer 1982, Smits and de Wilt 1988). For good animal health, they must be given an environment which meets their biological

needs. Individual rearing systems can affect the behaviour of the animals as demonstrated through studies on calves raised under intensive conditions (Kiley-Worthington 1983; Dellmeier et al 1985; Webster et al 1985; De Wilt 1985, Kerr and Wood-Gush 1987). However, the majority of these studies have not paid any special attention to the first month of life, the only month dairy calves spend in isolation. These animals will eventually live in group conditions and not, like veal calves, in individual boxes. It is necessary to find out whether the individual box system used during the first month of life, a situation which in no way resembles natural con-

ditions, could in any way jeopardise the animals' welfare, namely the species-specific ethogram (Friend and Dellmeier, 1988). In this preliminary study, the various behavioural patterns of Friesian dairy calves were observed; the calves were housed in individual boxes during the first month of life. In particular, on analysis of a first period immediately after birth and a second period at the age of one month, the authors attempted an evaluation of the animal's behaviour with special attention paid to unusual behaviour or to changes in the frequency of normal behavioural patterns in relation to the species-specific development.

Material and Methods

The study group consisted of ten Friesian calves. From birth, the calves were kept in straw-bedded, solid-side, individual, outdoor boxes about 0.75 x 1.21 m in size.

They were bucket-fed a milk-replacement diet twice daily at 6.00 and 18.00; hay and food concentrates were available *ad libitum* from a few days of life onwards.

The behaviour of each calf was recorded continually using a video-camera connected to an IFR projector and a time-lapse recorder. Recordings were made for a total of eight days - from birth to four days of age and from 26 to 30 days of age. Activity (standing) and rest (lying) behaviours were evaluated throughout the day and night (24 hours/day). The observations of the behavioural patterns were evaluated during the daylight (7.00 to 19.00). The behavioural patterns observed were defined as follows: exploration: nosing, sniffing, licking parts of the box, chewing and swallowing objects; play: prancing, kicking, pawing, vocalizing and head-shaking (Fraser and Broom, 1990). Feed searching was classified according to Redbo (1990) like a beginning of stereotypy: licking and sniffing inside the empty bucket, licking the feed trough, chewing hay or straw, repeated vocalisations. Self-

grooming was evaluated according to Fraser (1985): licking part of the body, scratching with a hoof, rubbing one part against another e.g. head against a leg. Inactive behaviours were also considered: standing and lying. Other behaviours in the list of the behavioural patterns were not considered as the frequency was very low.

The readings were made using the Time Sampling method, reading the behaviour for one minute every ten minutes. These parameters were chosen after determining that there was a variance of less than 10% between this type of sampling and continuous recordings (Martin and Bateson, 1993). With the time sampling method 1152 minutes of observation were obtained for each calf (6 minutes/hours for 24 hours for 8 days) for lying and standing. In the same way during daylight 576 minutes of observation were obtained for each calf.

The minutes of observation were analysed by non-parametric analysis of variance using the observation period and the calf as classes. The percentage time dedicated to the various behaviours were calculated for the two observation periods and for the entire day. Particular attention was paid to the 2 hours after sunrise and before sunset when the animals were most active (Fraser, 1974; De Wilt, 1985; Vitale et al., 1986), and at feeding times (meal in the afternoon). Feed searching and exploration were correlated using the Spearman correlation (Siegel, 1956).

Results

From the analysis of the observations of lying and standing over 24 hours, it would appear that these activities change during the first month of life. An increase in the amount of time standing (from 16.2% in the first period to 29.1% in the second period) was observed, with a consequent reduction in the lying times. In the hours around sunrise and sunset there is a variation in the standing and lying behaviours between these two obser-

CALF TERNERA	1		2		3		4		5		6		7		8		9		10	
Time Band Faja horaria	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Period 1	■	■	■	■	■	■	■	■	□	■	□	□	□	■	■	■	□	■	■	■
Period 2	□	□	□	●	□	●	□	□	□	●	□	●	■	□	■	□	■	□	□	□

A Sunrise Amanecer
B Sunset Atardecer

- Lying performed for a total time over than 75% of observed time
Standing performed for a total time between 0 and 25% of observed time
- Lying performed for a total time between 50 and 75% of observed time
Standing performed for a total time between 25 and 50% of observed time
- Lying performed for a total time less than 50% of observed time
Standing performed for a total time between 50 and 100% of observed time

Más que el 75% del tiempo hechado
Entre el 0 y 25% del tiempo parado

Entre el 50 y 75% del tiempo hechado
Entre el 25 y 50% del tiempo parado

Menos que el 50% del tiempo hechado
Entre el 50 y 100% del tiempo parado

Figure 1. Percentage of standing and lying of each in the two observation periods.

Figura 1. Porcentaje de tiempo parado y hechado de cada ternera en los dos periodos de observación.

vation periods (fig. 1). Lying decreased from the first to the second observation period. No lying on side was observed in the two periods. Analysis of the data for the behavioural patterns during daylight shows that all the behaviours, except standing inac-

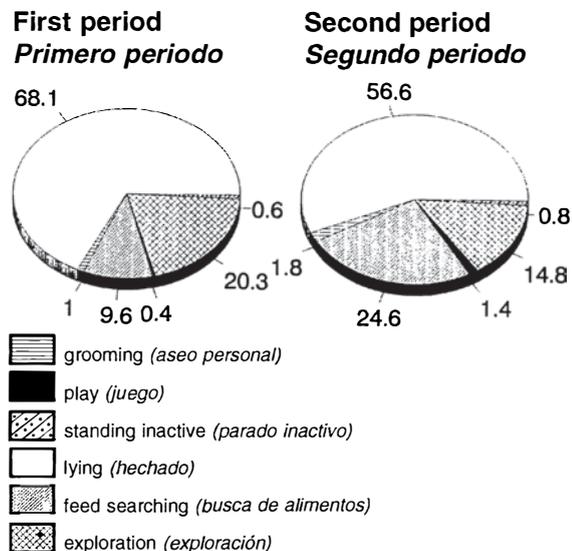


Figure 2. Percentage of behavioural patterns of the calves during the day.

Figura 2. Porcentaje de esquemas comportamentales de las terneras durante el día.

tive, statistically differed from the first to the second observation periods ($P=0.0001$). Feed searching and exploration were recorded with a relative

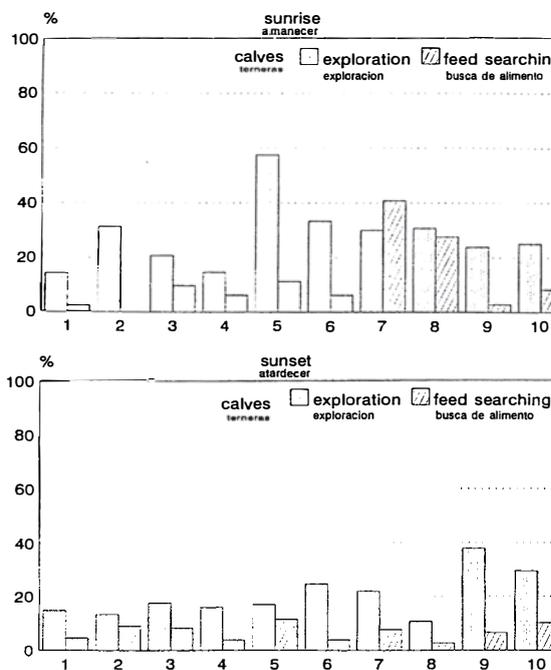


Figure 3. Exploration and feed searching in the first period.

Figura 3. Explotación y busca de alimento en el primero periodo.

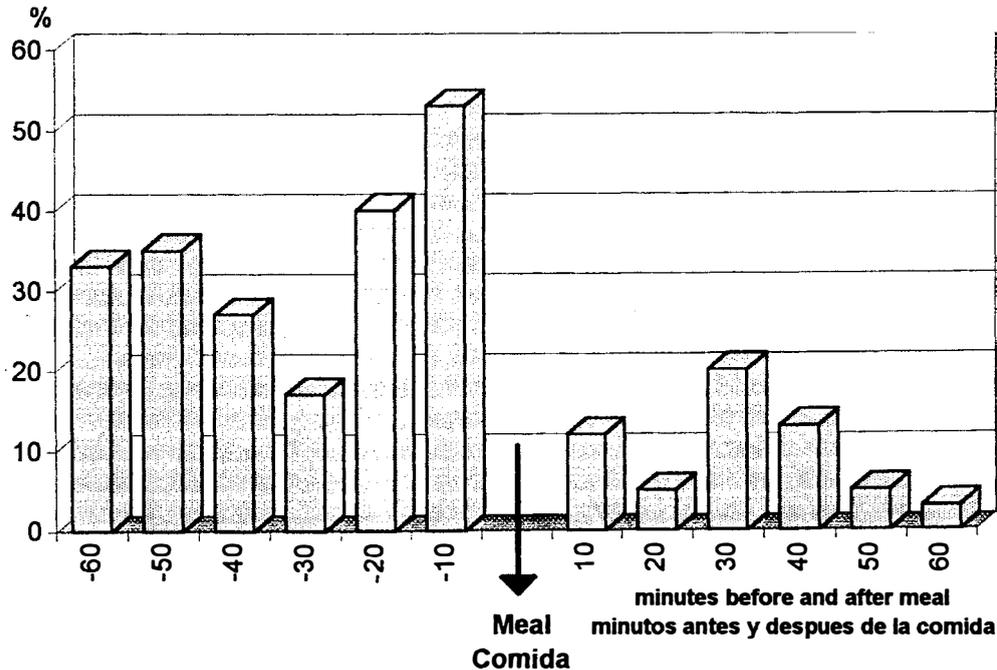


Figure 5. Percentage of feed searching one hour before and one hour after the afternoon meal in the second period.

Figura 5. Porcentaje de busca de alimento una hora antes y una hora después de la comida de la tarde en el segundo periodo.

vely high percentage right from the early days of life; instead play and grooming were observed in very small percentages (fig.2). In this study, exploration was one of the most frequent activities (20.3% in the first period).

The duration of feed searching increases with age ($P=0.0001$); the calves spent an higher percentage of time in feed searching rather than in exploration during the second period (24.6% vs 14.8%, fig 2). If exploration and feed searching are compared (for the same periods and for the same animals; fig.3-4), it can be seen that when the animal is particularly explorative, the percentage of time dedicated to feed searching is reduced. This finding is supported by the significant negative correlation between the two behaviours in both the first and second observation periods (First period: $*=-0.134$, $P=0.0001$; second period: $*=-0.195$, $P=0.0001$). The connection bet-

ween the amount of exploration and feed searching can be observed in all the calves in this study (figures 3-4). However, the development of feed searching is extremely subjective particularly in relation to the amount of exploration during the first observation period at sunrise (figure 3). It can be seen in figure 5 that feed-searching appeared close to meal-times and it is statistically greater before the meal ($P=0.0001$).

Discussion

Time spent in lying and standing activity in this study agrees with observations of calves living in natural conditions (Hafez, 1975; Webster, 1984; Fraser and Broom, 1990).

Nevertheless, even though the quantity of standing was increased from the first to the second

period, some of the individual animals behaved differently with a reduction in the amount of standing time. As the living conditions of all the animals observed was kept strictly homogeneous, a possible explanation for this could be the different physiological reactivity among calves (Wiepkema, 1987). The decrease of lying from the first to the second observation period, would appear to indicate that the individual box allows natural distribution of the standing and lying times (de Wilt 1985; Webster 1984). Regarding the absence of lying on the side this type of lying is important for relaxation of the body musculature and for the thermal regulation of the animal (de Wilt 1985; Webster 1984). So the lack of this type of lying perhaps due to the restricted size (width in particular) of the box, may in some way jeopardise the calf's welfare as showed by de Wilt (1985) in a study lying on veal calves which were tethered with a short chain.

Regarding exploration, different authors have already reported that a short period of confinement, in calves younger than one month, does not impair exploration behaviour of the calves whereas this behaviour almost disappears following longer confinement periods in animals of over one month of age (Kerr and Wood-Gush 1987); this fact was confirmed in this study.

Normally, exploration is the most frequent active behaviour observed in natural-living calves (de Wilt 1985, Fraser 1974). In this study the behavioural patterns change in the first month of life and feed searching seems partially replace the explorative activity. The greater amount of feed searching observed before the meal would suggest a period of animal activity, in addition to the peaks of activity at sunrise and sunset, probably correlated to the sucking requirement in natural conditions where activity peaks preceded the calves' meal-times (Vitale et al. 1986, Fraser and Broom, 1990). This behavioural pattern and its trend before the meal and at sunrise and sunset, may indicate that some animals are involved in a more intensive feed searching activity during these periods which replaces the normal exploration and grooming activities. This is probably connected to the fact that the animals are fed just twice a day and not more often as occurs in the natural environment (Fraser and Broom, 1990; Webster, 1985). In addition, the observation of this repetitive behaviour, mainly near the feeding time, may be the basis for the development of a stereotypy, as observed in veal calves (de Wilt, 1985).

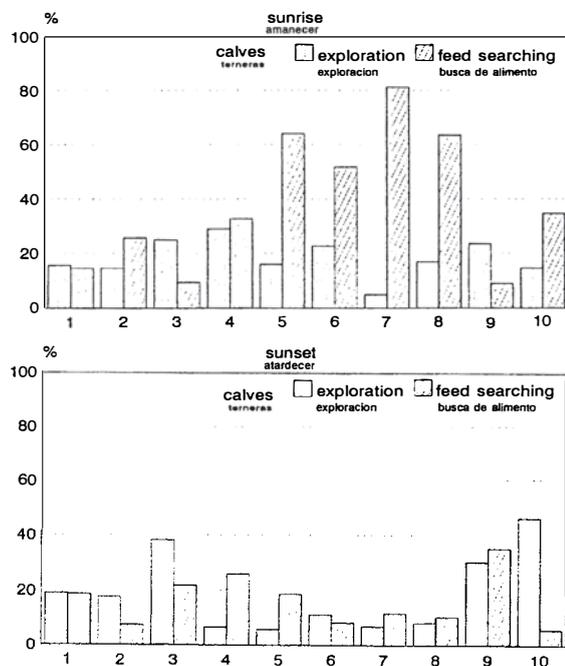


Figure 4. Exploration and feed searching in the second period.
Figura 4. Exploración y busca de alimento en el segundo periodo.

Conclusions

Housing calves in individual boxes during the first month of life does not appear to greatly change the percentage of lying and standing time in the animals observed in this study, compared to those in a natural environment (Fraser and Broom 1990, Vitale 1986). An evident reduction in the percentage

of lying over the month was observed, which would confirm the above statement. Nevertheless, a lack of lying on side was observed which would suggest that, even at a very young age, the small size of the box can influence the use of normal lying postures, reported in the species-specific ethogram. Of the observed behavioural activities, exploration developed normally. However, by the second observation period, a marked drop in this type of activity was observed and it was inversely correlated with an increase in the behaviour of feed searching. As the latter appears during the periods of greatest activity, and with percentages far in excess of those for grooming and play, it seems feasible to state that the calves have a suction need that seems not satisfied by the common feeding management, a fact which has already been underlined (Reinhardt, 1980; Fraser 1985; Kerr and Wood-Gush, 1987; Kopp et al. 1986; de Passillé et al., 1992). It emerged from this study that even though the calves and their living conditions were homogeneous, there were individual variations in the behavioural patterns even in the very early days of life which could be attributed to varying degrees of reactivity (Wiepkema, 1987) and therefore to the individual animal's capacity to adapt to a potential stressor such as the reduced size of its box and the effect of confinement.

So, although at present it is impossible to state whether the housing system during the first month of life has any influence on the behaviour and the performance of these animals in adult life, it is important that during this early period the animals develop correctly in accordance with the species-specific ethogram, while taking into account the different reactivity of each animal.

Acknowledgements

The authors thank the owners and the of the dairy farm "Speranza" and Ing A Bellazzi for their useful support.

Research supported by National Research Council of Italy, Special Project RAISA, Sub-project N 3, Paper N. 2947

Resumen

En el presente estudio no se han evidenciado diferencias en la actividad de hechado y parado de terneras criadas en boxes individuales durante el primer mes de vida con respecto a lo observado en otras investigaciones en medio natural. Las actividades de hechado y parado se modifican durante el primer mes de vida, manifestando un incremento del tiempo en que el animal está parado (del 16.2% en el primer periodo hasta el 29.1% en el segundo). Esta variación se manifiesta principalmente cerca del amanecer y del atardecer (fig. 1), aún que la distribución del tiempo hechado y parado sea diferente en cada ternera. Además, se ha observado una falta de la postura lateral durante el comportamiento hechado. Esto puede sugerir que, hasta en edad muy precoz, el tamaño reducido del box puede tener un efecto sobre el uso de las normales posturas en posición hechada, que son descritas en el etograma específico de esta especie. El análisis estadístico de los tiempos dedicados a los diferentes esquemas comportamentales durante el día ha evidenciado diferencias significativas ($p < 0.0001$) entre el primero y el segundo periodo en todos los comportamientos observados, con exclusión del comportamiento parado inactivo. Los comportamientos "busca de alimento" (descrito por Redbo, 1990) y "exploración" han sido observados en porcentajes de tiempo relativamente elevados en los primeros días de vida, mientras que el "juego" y el "aseo personal" se han manifestado por un porcentaje de tiempo muy escaso (fig. 2). El desarrollo de la "busca de alimento" varía entre terneras especialmente en relación con la cantidad de tiempo dedicado a la

"exploración" al amanecer en el primer periodo (fig. 3). Un tiempo más prolongado de "busca de alimento" ha ocurrido en las horas de mayor actividad (amanecer y atardecer). La "busca de alimento" se manifiesta más frecuentemente también cerca de la hora de la comida (fig. 5) y esta actividad es significativamente más elevada antes de la comida ($p < 0.0001$). Esto sugiere que hay otro pico de actividad además que al amanecer y al atardecer, que podría ser correlado con la necesidad de succión en condiciones naturales en las cuales los picos de actividad ocurren antes de la asunción de leche. En el presente estudio, se han observado marcadas diferencias individuales en los esquemas comportamentales de las terneras desde los primeros días de vida, aún que los animales y las condiciones exteriores fueran homogéneas. Esto podría ser debido a diferentes niveles de reactividad y entonces a la capacidad individual de adaptación a potenciales causas de "stress", cuales el reducido tamaño del box y la situación de aislamiento.

References

- de Wilt, J. G., 1985. *Behaviour and welfare of veal calves in relation to husbandry systems*. Thesis Inst Agric. Eng. Wageningen, The Netherlands.
- Dellmeier, G. R., Friend, T. H. & Gbur, E. E., 1985. Comparison of four methods of calf confinement. II Behavior. *J. Anim. Sci.* 60:1102-1109.
- de Passillé, A. M. B., Metz, J. H. M., Mekking, P. & Wiepkema, P. R., 1992. Does drinking milk stimulate sucking in young calves? *Appl. Anim. Behav. Sci.* 34: 23-36
- Fraser, A. F. 1974. *Farm animal behaviour*. Bailliere Tindall London.
- Fraser, A. F., 1985. *Body care*. In: *Ethology of farm animals*: 215-231 (A. F., Fraser, Ed.). Amsterdam:Elsevier.
- Fraser, A. F. & Broom, D. M., 1990. *Farm animal behaviour and welfare*. London: Bailliere Tindall.
- Friend, T. H. & Dellmeier, G. R. 1988. Common practices and problems related to artificially rearing calves: an ethological analysis. *Appl. Anim. Behav. Sci.* 20:47-62.
- Hafez, E. S. E. & Bouissou, M. F., 1975. The behaviour of cattle. In: *The behaviour of domestic animal*: 203-244 (E. S. E. Hafez, Ed.). Baltimore: Williams & Wilkins.
- Kerr, S. G. C. & Wood-Gush, D. G. M., 1987. A comparison of the early behaviour of intensively and extensively reared calves. *Anim. Prod.* 45:181-190.
- Kiley-Worthington, M., 1983. The behaviour of confined calves raised for veal: are these animals distressed?. *International Journal of study of animal problems* 4:198-213.
- Kopp, M. B., Friend, T. H. & Dellmeier, G. R., 1986. Effect of feeding method on non-nutritive oral activities in Holstein calves. *J. Dairy Sci.* 69: 3094-3099.
- Martin, P. & Bateson, P., 1993. *Measuring behaviour an introductory guide*. Cambridge: University Press.
- Redbo, I., 1990. Change in durations and frequency of stereotypies and their adjoining behaviours in heifers, before, during and after the grazing period. *Appl. Anim. Behav. Sci.* 26:57-67.
- Reinhardt, V., 1980. Social behaviour of Bos Indicus. *Rural Science* 4: 153-156
- Siegel, S., 1956. *Nonparametric statistics for the behavioral science*. Auckland: McGraw-Hill International.
- Smits, A. C. & de Wilt, J. G., 1988. Group housing of veal calves. In: *New Trends in Veal Calf Production*: 61-66 (J.H.M., Metz & CM., Groenestein, Eds). Proceedings of International Symposium. 14-16 March 1990, Netherlands: Pudoc.
- Steenkamer, N., 1982. Alternative housing systems for veal calves, their effect on welfare and performance and their economic feasibility. In: *Welfare and husbandry of calves*: 226-232 (J. P., Signoret, Ed.). The Hague: Martinus Nijhoff Publishers.

- Vitale, A. F., Tenucci, M., Papini, M. and Lovari, S., 1986. Social behaviour of the calves of semi-wild Maremma cattle (*Bos primigenius taurus*). *Appl. Anim. Behav. Sci.* 16:217-231.
- Webster, A. J. F., 1984. *Calf husbandry, health and welfare*. London: Granada publishing Ltd.
- Webster, A. J. F., Saville, C., Church, B. M., Gnanasakthy, A. & Moss, R., 1985. The effect of different rearing systems on the development of calf behaviour. *British Veterinary Journal* 141:249-264.
- Wiepkema, P. R., 1987 Behaviour aspects of stress. In: *Biology of stress in farm animals: an integrative approach*: 113-134 (P. R. Wiepkema & P. W. M. Van Adrichem Eds.). Dordrecht: Martinus Nijhoff Publishers.