

Using Video Photography to Assess Deviated Sucked Veal Calves Behavioral Patterns in the Western Massif Central of France

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Abstract: This study describes deviated behavioral patterns of sucked veal calves in the western massif central of France by using video photography. Camera video was placed in farms containing boxes with 2 calves in each one. The farms were selected according to conveniences and of frequency of observation of deviating behaviors. Calves were recorded on videotape from week 4 until week 16 to determine frequencies and durations of postures and behaviors (e.g., lying, standing, chewing, tongue playing, grooming, sucking, urine pumping and investigative activities). There were no consistent differences ($p > 0.05$) in postures or behaviors among calves. Calves spent approximately 71 and 31% in lying and standing positions. Depending on the watering method of the stockbreeders, water buckets were placed in front of the door of boxes. Relationships between proportion deviating behaviour, watering method and time since fed milk were examined. Calves showed a significant pattern of temporal cyclicity and in their deviating behavior with the highest average proportion of eligible deviation and hyperactivity at 9:00 and the lowest at 12:00.

Key words: Sucked veal calve, deviating behaviour, video photography

INTRODUCTION

Applied animal ethology has become an integral part of animal science in the last 40 years, as investigators have increasingly examined the physical and psychological needs of cattle (Banks, 1982). The ultimate causation of behavior has become a major focus in applied ethology in order to reach at valid approaches to animal welfare and improved husbandry systems which are more in line with the actual needs of the animal (Puppe, 1995). The terms welfare or well-being are often used interchangeably and describe a state in which an individual is existing within a range of acceptable physical, psychological and environmental specifications (Ewing *et al.*, 1999). Animal Welfare is generally used in a broader sense referring to the health and well-being of animals in any given situation. Farm animal welfare concerns animal feelings, such as happiness or suffering, bodily matters such as health and the question of whether animals lead natural lives and exhibit natural behaviors. Consumers of animal products want to see high standards of welfare for production animals. Good animal welfare has gradually gained more impact in the total quality concept

of the product. This will encourage scientists to continue to analyse the welfare status of animals and to come up with innovative solutions for the remaining problems.

Within the framework of the lawful evolution 629/91 of the practices of breeding and application of the Directive well-being, the stockbreeders had to modify some of their practices: housing without fastener out of collective boxes, removal of the muzzles, fibrous food contribution... With this mode of housing, the calves are generally maintained in baby-boxes (individual boxes or half-boxes) during the first eight weeks, in order to limit sucking between animals (Van Putten, 1982). Thus the calves have the possibility of introducing other food: for example straw of their litter, causing a potential contribution of iron; just like pump of urine of their congener, which can be either a deviating behavior or a natural one caused by the feeling of thirst. Currently, calves are housing up to 4 week of age in individual stalls usually 61-66 cm wide and 1.8 m in length. Terosky *et al.* (1997) concluded that similar individual housing designs or widths did not significantly influence growth performance or carcass traits but could be at the origin of stress in calves. Behavioral indicators of stress

include excessive self-grooming, increased proportion of time spent resting or standing and exhibition of stereotypic behaviors (Dantzer *et al.*, 1983; Bohus *et al.*, 1987; Veissier and Boissy, 2007). Quite naturally, the stockbreeders questioned themselves on the consequences for the colour and the quality of the criterion conditioning the price of the carcasses.

The objective of this study was to study the normal and/or abnormal behavior of suckled veal calves by using video photography. Relationships between watering methods were examined. Behavioral troubles were including chewing, self-grooming, nibbling wall of boxes, sucking their congener including urine drinking and chewing, tongue playing.

MATERIALS AND METHODS

Study herd: This observational study was conducted in farms in western massif central of France that housed suckled veal calves. The farms were selected according to frequency of observation of deviating behaviors. Total 639 animals were selected for this study. They were born during the month of July 2006. They are nourished exclusively with milk of their mother and bottle-fed recombined milk. Calves were fed twice daily at 07:00 and 17:00 and after 28 days, they were offered water following the morning feeding, depending on the watering method of stockbreeders. All calves were fed a commercial milk replacer diet in plastic buckets according to recommended feeding schedules for veal calves (Terosky *et al.*, 1997). The bottle-fed milk was given with variation according to the age; a total quantity for 4 months and half of fattening were introduced. Calves had no access to pasture or exercise lots. Total time spent away from the boxes was limited to 30 min daily. The stall barn housing the calves was composed of boxes containing each one two calves. The boxes were designed with a lying surface of 1.5 m wide by 2.5 m long. Boxes were bedded to a depth of approximately 15 cm with straw and were raked and groomed once daily while the calves were away bottle-fed milk. Water was delivered occasionally into a bucket. It depends on the watering method of the stockbreeders. The exact time of each of the aforementioned events were recorded following review of the videotapes.

Video recording: Video camera was evenly installed in breedings where the frequency of observation of deviating behaviors was important. Four calves in each of the five production groups representing deviating behaviors were recorded on videotape using 5 Panasonic BP 100 video surveillance cameras (General Electric Co.,

France) with telephoto lenses (Panasonic WV-L281/6A auto iris zoom lens 8.5-51 mm; General Electric Co. of France) and a time-lapse videocassette recorder (Panasonic Model AG-6024 DC, General Electric Co. of France). The recording was conditioned with a sensor of movement; the camera was equipped with an infra-red sensor for the recording in night period. Each camera recorded four calves simultaneously during a 24 h period; a film frame was recorded during 2 min. The camera was placed about 5 m above the pen floor to allow more complete visualization of the boxes. The videorecording and monitoring equipment was in an adjoining room; all cameras remained in place for the duration of the experiment.

Postural activities included lying and standing; among the deviated behavioral activities were tongue playing (including tongue rolling and other activities not directed to a specific object), investigative activities (licking or smelling objects: stall, bucket, bucket holder, etc.), urine pumping and suckling their congeners. Videotapes were viewed using the software of Remote playback client®; observations were independently recorded for each calf (one observer per calf per tape). Although, images were recorded on film with 2 min duration, samples due to the labor-intensive efforts required to review the tapes and our belief that hourly observations would adequately capture deviating behavior. During each observation period of 2 min, behaviors were recorded as either being observed or not observed. A behavior was recorded as one occurrence within that time period, regardless of the frequency. Because all behaviors observed during each 2 min observation interval were recorded, there was the possibility of duplication of behaviors. For example, during one 2 min observation interval, it is possible that the same calf was observed both standing and lying due to changing posture within the observation interval. The occurrence of each behavior (or posture) was then summed over all 2 min observation intervals for 4 calves and expressed as a percentage of all 1 h periods for four calves. All data were entered into a computerized spreadsheet program (Microsoft Excel®).

RESULTS

Environnemental data: During the study period, management routines remain constant. During all observations, calves were seen leaving the boxes two times daily within 15 min for milk feeding. They were seen without muzzle and without fastener in the boxes. In some farms, where bucket water was used permanently, only one deviating behavior was observed, generally chewing,

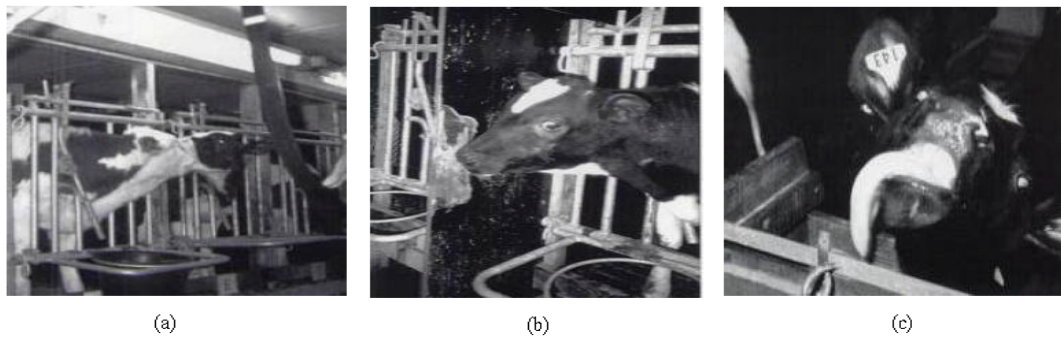


Fig. 1: We observed with video capture the following behaviors: chewing, self-grooming, nibbling wall of boxes (a) with 52% of observations, sniffing other calves, licking other calves, cross sucking (including urine drinking), (b) with 35% of observations and tongue playing, tongue rolling and (c) with 13% of observations (Photos I. Veissier)

self-grooming. In other farms, where water was occasionally or never used, 2 deviating behaviors were often observed at the same time. These included acts of cross sucking, licking themselves (including urine drinking), tongue playing and tongue rolling.

Deviating calf behavior: On 639 calves having integrated the experimentation, only 143 presented one or more deviating behaviors during the period of analyses. We showed in Fig. 1, the following behaviors: chewing, self-grooming (Fig. 1a), sniffing other calves, licking other calves, cross sucking including urine drinking (Fig. 1b), tongue playing, tongue rolling (Fig. 1c). A more detailed description of these behaviors was reported by Mattiello *et al.* (2002) and Wiepkema *et al.* (1985). The following general behavioral categories were observed from the videotapes and were gathered in four categories: calf posture (standing or lying), contact bucket, structures (self-grooming, chewing, licking, sniffing, biting, nibbling), sucking other calves (including urine drinking) and tongue playing, tongue rolling. Deviating more observed was the second category with polyphagic behavior (lick and eat anything, self grooming) at 57% by the stockbreeders' observations, at 42% at the time of blood test and 52% with video recording. The summary of the behaviors expressed as a percentage of deviating is represented in Table 1. The average age at appears of these deviations depend on the type of deviance. The first deviant behaviour observed was urine drinking that appears on average around 68 days and lasts about two weeks. The polyphagic appears to be slightly later, about 78 days and stay for 8 days. The last observed behavior: rolling tongue occurs at a later age or approximately 106 days and lasts about 11 days. The standard deviation of age at onset of these deviations is quite high which suggests a high variability. The proportion of each deviating calf behavior at each time period are shown in

Table 1: We represent the distribution expressed as a percentage of the various deviances observed by the stockbreeders, at the time of the blood test and by the recordings of the video captures

Type of variance	Observation of stockbreeders	At time of blood test	Recording by video captures	Moyenne
sucking (including urine drinking)	29	29	35	30 25-35
Polyphagia (licking wall /coprophagie)	57	42	46/6	55 50-60
Tongue playing, rolling	14	29	13	15 10-20

Fig. 2; it represents the sum of observations of 4 calves into 2 boxes at the same time. The highest proportion of hyperactivity and deviating behavior observations was seen at 9:00, 2 h after fed milk with 261 observations of hyperactivity (standing), 133 of polyphagic, 66 of sucking and urine drinking and 44 of rolling tongue. At 18:00, we can detected another pic slightly lower with 135 observations of hyperactivity (standing), 85 of polyphagic, 64 of drinking urine and 16 of rolling tongue. Although, decreased deviating behavior was observed during mid-day and early evening hours. Any of the deviating behaviors was observed before 8:00. During our observations, the calves lying down during the hours of 1:00 to 7:00, with the exception of a little standing and deviating behavior. Our findings of increased resting in the early morning hours are supported by circadian cycle research investigating sleeping habits and resting needs of cattle (Ruckebusch, 1972). Other research have found that confined cattle and calves demonstrate greatest synchrony of lying behavior during the hours around sunrise (Miller and Wood-Gush, 1991).

The daily observation period with the lowest average proportion of deviating behaviour was 12:00 with 68 standing observations, 21 of polyphagic, 16 of drinking urine and 4 of rolling tongue. Other times that had similarly low proportion were 15:00, 20:00 and 23:00. 12:00

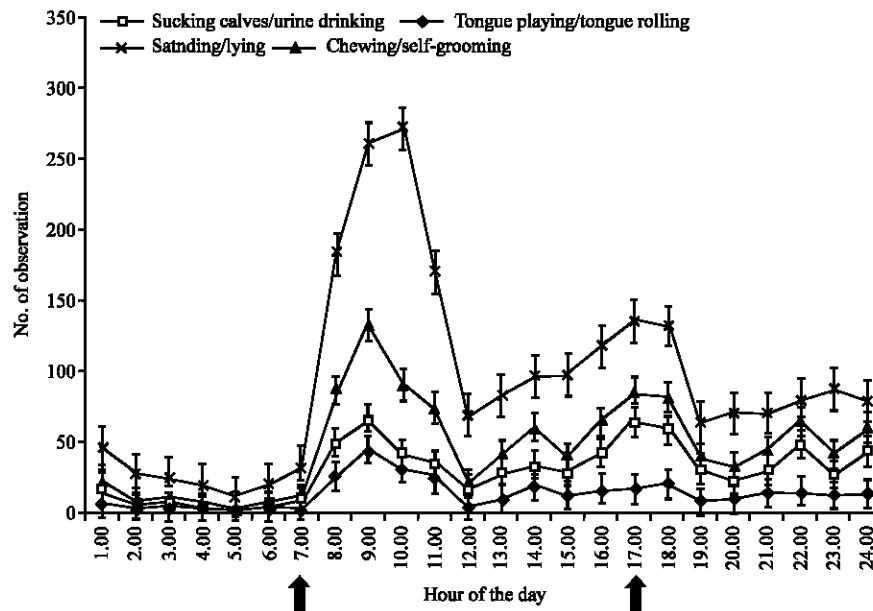


Fig. 2: The graph shows the variation of the behaviour deviating of calves during 24 h: calf posture (standing or lying) (x), feed straw, self-grooming, chewing and nibbling wall of boxes and bucket (▲), contact with other calves [licking, sniffing, biting, nibbling, sucking (including urine drinking)] (□) and tongue playing, tongue rolling (◆). Bold arrows indicate times at which the calves left the boxes for fed milk. Calves left at 07:00 and 17:00 for each of the two fed milking and returned within 15 min

correspond to midday, 5 h after the calves were fed milk. At the same time, 20:00 was associated with the period of three hours after feeding milk. These decreases in deviating behavior were likely a result of synchronisation associated with feeding, because more than 3 h after feeding, lying behavior desire might be more important.

DISCUSSION

These four criteria are to be taken into account for the study of the wellbeing of the animals. It is classically allowed that the behavioral criterion is most sensitive (Veissier, 1996), come then the physiological criteria then zootechnical and finally that medical. Calves in insulation present a modification of behavior (hyper-reactivity) but not of deterioration of the other criteria. If their conditions are degraded by a restriction of their movements, we observe in more of the locomotor hyperactivity, a response exacerbated out of cortisol following a stimulation of the ACTH (Dellmeier *et al.*, 1985; Friend *et al.*, 1985; Wilson *et al.*, 1999). This gradation cannot always be applied. Calves raised in some 0.60 m broad boxes have a growth lower than those high out of boxes of 2.10 m without the operation of their axis corticotrope not varying.

Calves receiving only a liquid food present activities of chewing during approximately 2 h per day. Non food oral activities are also observed such as non food nibbling, the licking between animals or of elements of the box, suckling between animals, rolling tongue. These activities are frequent in butchery calf and rare in pasture calves what led the European Commission to take measures to limit these activities of substitution. These activities can be decreased if calves are growing on straw (Bertrand and Martineau, 1995) or if they receive a solid food and particularly if this one is rich in cellulose. Among the non food activities, suckling depends primarily on the milk diet. That it is food or not it is stimulated by the components of milk and particularly lactose. The access to objects to be sucked, as dry tétines can decrease them. The rich foods in cellulose make it possible to decrease the nonfood oral activities.

We can note with all the same a high standard deviation, translating a strong variability, that the behavior urine drinking, appears on young calves followed by deviating polyphagic. Chewing tongue appears on the oldest calves, in the same way, it would seem as this behavior is expressed in a way more durable than the two others. The highest proportion of deviating behaviour was observed at 9:00, 2 h after sucking. One of the deviating behavior most observed is sucking

congeners. Non-nutritive sucking is elicited by the ingestion of milk and the lactose concentration in milk, rather than that of fat or protein, is the main factor stimulating non-nutritive sucking. Every time a calf drinks milk, it is stimulated to suck and deprivation of sucking may interfere with digestive processes or satiety. To understand the behaviour of the calf during nutritive sucking, De Passillé (2001) examined the effects of milk flow on calves' sucking and butting an artificial feeding system. Slowing and stopping the flow rate stimulates butting and can lengthen the duration of sucking for the meal. It also stimulates the calf to switch teats when a second teat is available. Other times that had higher proportion of deviating behavior were 14:00, 18:00 and 22:00. 18:00 which corresponding to 1 h after the second time fed milking. It also can be due to the increasing pressure to suck caused by milk. In other studies, Osterman and Redbo (2001) showed that increasing intramammary pressure and anticipation may cause cows to stand or move toward the exit gate, that is why the pic of higher proportion of deviation, as shown in Fig. 2, start at 17:00 and continue until 18:00. Environmental temperatures also influenced proportion of deviating behavior. Although, most of videos were recorded during the summer, period of high temperature and some of them in autumn that why, as shown in Fig. 2, higher proportion of deviating behavior were observed in the afternoon at 14:00. It is noted that the variation of the deviating behavior is proportional to the fact that the calves are hyperactive and standing. As shown in Fig. 2, the deviating behaviors increased when the calves were standing. Overton *et al.* (2002) has shown that lying proportion decreased as pen temperatures increased. Moreover, Shultz (1984) has shown that percentage of cows standing increases as environmental temperatures increase.

On the other hand, the water supply also appears to be important. In the group without watering, 67 calves were rated deviant compared to 76 in group where water was at will. As reported in the Table 1, the proportion of each deviating behavior, was demonstrated by the stockbreeders, at the time of taking of blood and by analyses of the recordings by video capture. The highest proportion of deviating behavior which correspond to feed of straw, self-grooming and chewing (57, 42 and 46.6%, respectively) was observed in breedings where water was used permanently or occasionally. Licking themselves and sucking (including urine drinking) and tongue playing, rolling had lower proportion (29, 29 and 35%, respectively and 14, 29 and 13%, respectively) and corresponded to the breedings where water was never used or occasionally. In the current study, buckets were

not removed from the bucket holders between feeding times, giving the calves an additional object to investigate, chew and play. Veissier *et al.* (1997) concluded that providing additional objects (pieces of tire or chain) upon which to nibble reduced the time the calves spent licking themselves from 7 to 4%. As demonstrated in the introduction, some of these behaviors, like pump of urine or chews with the tongue can be either a deviating behavior or a natural one caused by the feeling of thirst (Gottardo *et al.*, 2002).

The stockbreeder has a fundamental role in the prevention and the control of the diseases. Indeed in addition to vaccination, the care which it takes to cleaning boxes and the observation of animals in order to take measures of segregation as soon as a calf has symptoms, is essential. The work of the stockbreeder near calves depends on the stage of fattening. The first days the stockbreeder passes much from time with the animals in order to learn them how to drink. Once this stage passed, the contact is shorter and more repetitive. In the feeding systems with an automatic distributor of milk, the contacts of the stockbreeder with calves are held at the time of the maintenance of the litter. In the breedings with the buckets, the stockbreeder must pass close from each calf at least twice daily. It is during these moments that the stockbreeder can control the medical state of calves and that it can interact with them (Lensink *et al.*, 2000a). The contacts are varied and go from the positive contacts (the caress, to let suck the fingers) to negative attitudes (to strike, to give stick or kicks, to push back calves). The contacts which the stockbreeders with their calves have depend on the image which they have of them. Those which consider them even intelligent sensitive have more positive contacts (Lensink *et al.*, 2000b). These interactions have impacts on the behavior of calves. As shown in Fig. 2, we observed an important appearance of the deviances at the time of the contact with stockbreeders, in the morning at the hour of the first fed milk and in the end of the afternoon, hour of the second one. Animals having received soft contacts in the youth showed less fear vis-a-vis with the man later in their life than of the control animals (Windschnurer *et al.*, 2008). In experiments, it was shown that soft contacts reduce the tendency of calves to avoid the man (Lensink *et al.*, 2000a) and a phenomenon of generalization, with an unknown approach of anybody, were observed. The contact in oneself can be a reward, but in calf the caresses alone do not seem sufficient (Boivin *et al.*, 1998; Krohn *et al.*, 2001). The calves receiving of the positive contacts, are easier to handle than the others. This has a cardinal importance at the time of transport at slaughterhouse. The calves raised in group seem more agitated

than those out of individual box (Veissier *et al.*, 1998). This has effects on the quality of the meat, it is allowed that the stress is at the origin of defect of quality (Gregory and Grandin, 1998). In addition, the stressed animals are more difficult to handle and are more likely to be wounded at the time of the loading and unloading. This can create haematomas which induce economic losses.

CONCLUSION

The abnormal behaviors touch 1 calf out of 5. These behaviors appear tardily (approximately 2nd month, between 60 and 120 days). Coprophagic accounts for 55% of deviating, sucking other calves and urine drinking 30% of deviating and 15% of tongue chewing tongue rolling. To assess the welfare state of an animal, many behavioural, physiological and biological indices need to be taken into account. The living conditions of farm animals are often chosen according to production objectives and may not always ensure a high level of animal welfare. At the same time, a low welfare state can have adverse effects on animal productivity. The stockbreeder can also influence the well being of calves and their behaviors by his attitude towards them Video photography is a valuable tool for investigating calves under mother behavioral patterns. Environmental temperature may have significant effects on deviating behavior of calves. Fed milking occurred at very consistent times throughout the study period influenced behavioral patterns. The watering method also influenced the type of deviating behavior, with observed of chews of tongue and pump of urine where water was never used or occasionally and feed of straw in breedings where water was used permanently or occasionally. Water must be at disposal to avoid a hemoconcentration.

ACKNOWLEDGMENT

This research was supported by la Chambre d'Agriculture de la Corrèze.

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