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Is dairy calves grazing behaviour influenced by cow-calf contact experience?

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Key words: grazing behaviour, herbage selection, dairy calves, experience, cow-calf contact, post-weaning

Abstract

Cow-calf contact is encouraged in organic dairy systems and increasingly requested by consumers nowadays. Rearing dairy calves with their mothers can teach calves how to graze and optimise grass use, as well as improve their welfare and growth. In the present study, we tested the short-term effects of cow-calf contact experience on the grazing behaviour of three groups of eight calves during their first two grazing days after weaning. 'Dam' calves (D) were reared and grazed with their mothers until weaning. 'Mixed' calves (M) were separated from their mothers after three weeks, thus experiencing cow-calf contact but not at pasture. 'Control' calves (C) had never experienced mother's contact (separated at birth) or grazing. All calves started grazing on three similar plots offering heterogeneous vegetation. Scan sampling of calves' activities were performed every 5 min, 6 hours per day (9h-12h and 14h-17h). Proportion of time spent grazing, ruminating and idling were calculated. In addition, for all these activities, the proportion of time calves spent isolated and lying was also calculated. When grazing, observers classified the type of grass chosen by calves (green or dry). Once turned out to pasture, calves from the three groups spent between 55 and 60 % of their daily time grazing; D-calves started grazing immediately (1 ± 4.6 min) unlike M- and C-calves (39 ± 4.6 and 23 ± 4.6 min). The day they were turned out to pasture (Day0), M- and C-calves grazed more dry patches than D-calves. Finally, these differences in behaviour between the three groups were mainly observed on Day0 and disappeared the following day. Consequences on calf's welfare and growth should be further investigated in the long term.

Introduction

In organic dairy farms, cow-calf contact and grazing experience are encouraged. Dairy calves reared with their mothers could learn how to optimise grass use. Pullin et al. (2017) found that lambs grazing with their dam spent more time foraging, were more active, developed long-term feed preferences and learned about aversion to toxic feed more effectively. Dam is the primary social model for young animals, and dominant conspecifics also play an important role concerning grazing behaviour and feed selection (Hessle, 2009). Therefore, dairy calves that learned to graze with their dam might be more efficient in recognising quality herbage when turned out to pasture post-weaning, compared to calves that have never grazed before.

However, it is unclear if this advantage is observed only in the first grazing day or is more persistent. The aim of our work was thus to test if the previous experience of cow-calf contact and early grazing influenced the behaviour of calves on their two first grazing days, and whether calves that experienced dam contact were more sociable.

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Material and methods

The experiment took place in 2019, at INRAE Herbipôle experimental farm (DOI: https://doi.org/10.15454/1.5572318050509348E12) located in the Massif central (Marcenat, 45°15'N, 2°55'E; 1150 m a.s.l.). All animal related procedures were carried out in accordance with the guidelines for animal research of French Ministry of Agriculture and all other applicable national and European regulations for experimentation with animals (https://www.recherche-animale.org/sites/default/files/charte_nationale_portant_sur_l_ethique_de_l_experimentation_animale_243579.pdf).
Three groups of eight dairy calves with different experience backgrounds were compared: a group of 'Control' calves (C) that had been separated at birth from their dam and never experienced grazing; a group of 'Dam' calves (D) that had been reared and grazed with their dam until weaning; and a group of 'Mixed' calves (M) that had been separated from their dam at 3 weeks of age and never experienced grazing. All calves were weaned at the age of 11 ± 1 weeks.
Before weaning, D-calves were housed separately from their dams at night and had free access to the dam cowshed during the day. Starting from 5 May, when the calves were 4.6 ± 3.2 weeks old, the day cowshed access was replaced by free access to pasture with the dams. M-calves, until the age of 3 ± 1 weeks, were reared in the same way, except that they did not have access to pasture. From this age until weaning, they were reared like C-calves, *i.e.* in a separate housing and fed with an automatic milk dispenser. D- and M-calves were reunited with their dams after morning milking at 9h and separated before evening milking at 15h30. All calves had access to hay and 0.2 to 2.0 kg/d/calf of concentrate from Week3 to Week11. At the beginning of the experiment, D-, M- and C-calves were respectively 14.9 ± 3.2, 16.1 ± 2.8 and 15.3 ± 3.6 weeks old. They had been weaned for 30 ± 22, 33 ± 20 and 33 ± 24 days, respectively.
Calves were turned out to pasture on 22 July (Day0), from 9h to 17h. They grazed on three similar 0.15 ha plots offering heterogeneous vegetation, with permanent access to water. No close visual contact was allowed between the three groups. On each plot, four calves were randomly assigned to two observers who recorded the calves' behaviour by scan-sampling every 5 min, 6 hours per day (9h-12h and 14h-17h), for two consecutive days (Day0 and Day1). Each day, the time taken by calves to start grazing was measured. Then, activities were differentiated into three groups: ingestion (grazing and drinking water), rumination, and idling. The latter comprised 3 further categories: resting (observation, sleep and self-grooming), socialising (allogrooming and domination) and *ad hoc* activities (walk, exploration, stereotypies and vocalisation). When calves were grazing, observers distinguished whether the herbage chosen by calves was green or dry, and the proportion of dry herbage chosen by calves was calculated over the total number of grazing observations. The daily proportion of ingestion, rumination and idling time was calculated as a percentage of total daily observation. The daily proportion of resting time, socialising time and *ad hoc* activities was calculated as a percentage of the idling activities. Furthermore, each time one of the activities was recorded, observers also indicated if the calf was grouped with other calves or isolated, and if it was standing or lying. The daily proportions of time spent in the group and standing were calculated over the total number of observations.

All data were analysed using the MIXED procedure of SAS software. The model included the fixed effects of group (D, M or C), day (0 or 1) and their interaction. Calf was considered as the subject of repetition and day as repeated factor with a compound symmetry covariance structure. Normality of the residuals was checked using Shapiro-Wilk test. Differences amongst least square means were considered significant when $P<0.05$.

Results

On Day0, when arriving on pasture, D-calves started grazing immediately (Table 1), whereas it took C-calves around 20 min before they actively started to graze. The M-calves needed a

further 20 min. Even though D-calves started grazing earlier than M- and C-calves, over the entire Day0 they did not spend more time ingesting. It seems rather that it gave them more time to ruminate (+5 % in average). In addition, on this day, M- and C-calves grazed about 10 times more dry patches than D-calves. The differences in grazing behaviour observed on Day0 between the three groups were no longer observed on Day1. Indeed, all calves started grazing on average 5 min after arriving on pasture and lost interest in dry patches, which only represented about 2% of their diet.

Table 1: Effects of day, group and their interaction on the time to start grazing, percentage of daily activities, herbage selection and social interaction of calves.

Item	Day	Dam	Mixed	Control	SEM	Group	Day	Group × Day
Time to start grazing (min)	0	1 ^{c}	39 ^{a}	23 ^{b}	4.6	***	***	**
	1	6 ^{c}	4 ^{c}	4 ^{c}				
Daily activities (% of daily total observations)								
Ingestion time	0	55	61	60	2.5	ns	*	+
	1	56	52	55				
Rumination time	0	15 ^{a}	8 ^{bc}	11 ^{b}	1.3	+	***	**
	1	7 ^{bc}	7 ^{c}	9 ^{bc}				
Idling time	0	30	32	30	2.7	ns	***	ns
	1	37	42	36				
Herbage selection (% of ingestion observations)								
Dry patches	0	2 ^{b}	29 ^{a}	26 ^{a}	2.7	***	***	***
	1	0 ^{b}	2 ^{b}	5 ^{b}				
Idling activities (% of daily idling observations)								
Resting time[1]	0	57	47	54	3.8	+	***	ns
	1	74	65	67				
Ad hoc activities[2]	0	35 B	49 A	38 AB	3.7	*	***	ns
	1	24	29	29				
Socialising time[3]	0	8 ^{a}	3 ^{bc}	8 ^{a}	1.5	ns	*	**
	1	2 ^{c}	6 ^{ab}	4 ^{bc}				
Proportion of time (% of daily observations) spent:								
Lying	0	16 B	13 B	24 A	2.2	***	ns	ns
	1	16	11	28				
Isolated	0	17 ^{c}	18 ^{c}	26 ^{b}	2.5	***	**	**
	1	23 ^{bc}	16 ^{c}	39 ^{a}				

***P<0.001; ** P<0.01; * P<0.05; + P<0.10; ns P≥0.10
$^{a-c}$Means within a variable with different superscript letters differ at P<0.05
$^{A-B}$Means of group effect differ at P<0.05
[1]*Resting time*: observation, sleep, self-grooming
[2]*Ad hoc activities*: walk, exploration, stereotypies, vocalisation
[3]*Socialising time*: allogrooming, domination

Regardless of day, the activities of calves during their idling time differed between groups. The D-calves tended to spend more time resting than M-calves (65 ± 2.9 versus 56 ± 2.9 %), with C-calves being in the middle (61 ± 2.9 %). Instead of resting, M-calves had more *ad hoc* activities than D-calves (39 ± 2.5 versus 29 ± 2.5 %), whereas C-calves did not differ from either of the other groups (33 ± 2.5 %). Overall, D- and M-calves showed more gregarious behaviours than C-calves, while the latter spent more time lying (26 % of daily observations) and isolated (33 % of daily observation). This latter difference was even stronger in Day1 than in Day0.

Discussion

Experiencing pasture with dams facilitated calves' grazing behaviour only for a short time, as all differences disappeared after the first day. This study showed that the M rearing system for calves resulted in the longest time to start grazing, whereas D-calves started grazing within the first five minutes on pasture. The M- and C-calves, which only experienced a hay-based diet, with or without the dam, did not particularly avoid dry patches on their first grazing day on the contrary to D-calves. Besides grazing behaviour, dam-calf contact in the early stages of life influenced the social behaviour of calves. Again, while idling, M-calves had the most different behaviour from D-calves in terms of *ad hoc* activities, which means that overall, they spent more time actively walking and exploring, in addition to occurrences of vocalisations. This showed their discomfort in adapting to this new situation, which suggests that further consequences on their behaviour could occur in the long term.

Suggestions for research and support policies to develop further organic animal husbandry

Cow-calf contact in early life did not give a substantial advantage to dairy calves concerning grazing ability. Our results suggest that cow-calf contact and its duration influences more social than grazing behaviour of calves, probably leading to welfare concerns. The latter should be further investigated, as much for calves as for dams.

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