

Evaluation of Routine Rearing Work for Human-Animal Interactions in Commercial Dairy Farm

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Abstract

The objectives of this study was to classify the routine rearing work based on a stockperson's working position and to examine the relationship between the working time for animals and the reaction of animals in a commercial dairy farm. The observation of working time was conducted in four commercial dairy farms during a six months period (six times of observations in each farm). The work was categorized into three jobs (feeding, cleaning and transfer), and categorized into three types of work (inside work, outside work and outside existence). In four days of six working observation days in each farm, flight distance of cows was measured. Total frequency of contact with animals was no significant difference among three jobs. The stockperson(s) gave 30.1 contacts during the inside work and 6.3 contacts during the outside work. From birth to first calving, the cattle got longer inside work than outside work in farm A and C. The average of flight distance of cow in farm A was the lowest and followed by farm C. The cumulative time of inside work over the rearing period and after weaning period significantly ($P < 0.05$) correlated with the flight distance. It was suggested that less inside work during younger age of cattle became poor relationship between human and cows in dairy farm.

Key words: human working position, human-animal interaction, flight distance

As farming systems become more automated, opportunities to develop associations between human and animals will decrease. There was a large variation in human-animal interactions across the commercial farms⁴. Bovin *et al.*³ showed that the traditionally-reared calves were easier to be handled than the range calves. It is also experientially known that an animal's reaction to a human differs among commercial dairy farms.

There were many reports that dealt with the effect of human handling on human-animal relationships in experimental conditions, as reviewed by Hemsworth *et al.*⁵. In some studies, the relationship was changed by a short time of optional handling like petting or brushing^{1,2}. In these experiments, no reports analyzed the effects of the interactions during routine rearing work. Jago *et al.*⁶ investigated the effect of feeding and handling on the response of cattle to humans and concluded that feeding has a greater influence than handling. The effect of optional contact to animals on human-animal relationship might differ with the frequency of contacts during routine work whenever the routine work was done the same with control (zero optional contact treatment). The contact frequency during routine rearing work should be analyzed for evaluating the effect of handling on human-animal interactions.

In commercial dairy farms, the human-animal relationship might not be built by these optional contacts, but might be formed by some interac-

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tions during the routine rearing work. The animals might be given many stimuli (visual, auditory or olfactory, etc.) from human during routine rearing work in dairy farm. The human-animal interaction during routine work is different with the position between human and animals during work. The position between human and animals during routine rearing work varies with the type of work in dairy farm. Therefore, it is important to know what type of routine work is done, and how long a stockperson spends rearing work for animals (time study of routine work) from aspect of human-animal interaction.

The time study of the routine works on commercial farms has been made only from the aspect of labor saving and increasing of labor efficiency, but has not been made from the aspect of formation in the human-animal relationship^{8,9)}. There was no report on the relationship between the time spent on rearing management and human-animal interactions in commercial dairy farms.

In the time study for labor saving and increasing of labor efficiency, routine work is categorized according to the subjects of the job (e.g. milking, feeding, cleaning, etc.). These categories are not suitable for the evaluation of work in commercial farms in the aspect of human-animal interaction because relative working position to animals that is important to human-animal interaction differs in several housing layouts (e.g. trough is inside or outside of rearing area) even if the stockperson worked for same subject (e.g. feeding). The objectives of this study was to classify the routine rearing work based on a stockperson's working position and to examine the relationship between the working time for animals and the reaction of animals in a commercial dairy farm.

cial dairy farm.

Materials and Methods

The measurement of the working time was conducted in four commercial dairy farms once a month during six months. The average number of cattle and stockpersons in observation days are shown in Table 1. There were two types of rearing system of cows, tie-stall and free-stall system. There was a difference in the number of cattle and stockpersons between four farms.

Works in the rearing area of calves and heifers and contact with animals during work were recorded by an 8mm Video recorder from the start to the end of work. The works were categorized into three jobs, i.e. feeding, cleaning, and transfer (e.g. moving cattle to paddock or pasture). Those were also categorized into inside work, outside work and outside existence that were defined by human position and subject of work as follows.

Inside work for cattle: stockpersons worked inside of the pen. There was no fence between cattle and stockpersons. Outside work for cattle: stockperson worked outside of the pen in which the cattle reared. There was fence between the human and animals during work. Outside existence of person: Stockpersons worked or only were outside of the pen. They were near the pen, but they don't work for cattle reared in it. For example, stockpersons just walked through the front of the pen, swept the passage in front of the pen, or worked for the cattle in other pens.

If the inside work or the outside work for cattle was also the outside existence for other cattle, this work was applied to each work. When the stockperson worked in a group-rearing pen or

Table 1 Average number of cattle and stockpersons

	Farm			
	A	B	C	D
Type of rearing cows	Tie-stall housing		Free-stall housing	
Cows	36	54	105	102
Nursing calves	2	6	8	11
Heifers	13	20	42	109
Stockpersons	2.2	2.0	4.3	4.7

worked for group-rearing cattle from the outside, this work was counted for every cattle in the pen. The stockperson's work in a vacant pen (cattle was moved out) was not counted to working categories of human position. Thus, the total time of every working categories of human position was not total labor time of humans, and was the total time of interaction of cattle with humans.

Total working time from birth to first calving was defined as cumulative working time and it was calculated from daily working time in several growing stages and rearing days of these stages. The group size and days of several growing stages of calves and heifers in each farm is shown in Table 2. There were differences in rearing methods (number of cattle in a pen) and stages among four farms. The number of cattle in a pen was checked at the observation day. The stockperson's contacts to cattle during routine work were classified into 3 categories, strike, push and touch.

Forty-three cows were selected to measure flight distance in four commercial dairy farms. In four of six observation days, flight distance was measured. Measuring was conducted in free-stall barns, outdoor paddocks, or pastures.

Wilcoxon-Mann-Whitney two-sample test¹⁰⁾ was used for comparing the cumulative working time calculated from daily working time in four farms. The correlation coefficients were calculated between natural logarithm of working time in each category and the average of flight distance in each farm.

Results

The daily working time was categorized into jobs as shown in Table 3. In the nursing stage, working time of feeding in farm A and B was significantly ($P < 0.05$) shorter than that in other farms. The time of cleaning in farm D was significantly ($P < 0.05$) longer than that in other farms. There was no time for work of moving calves from their pen to the other place in farm A.

Table 2 The group size and days of several growing stage of calves and heifers

		Farm			
		A	B	C	D
Number of stages		3	3	3	4
Nursing calves group size ¹		single	group (2-4)	single	single or group (2)
	rearing days	60	75	75	60
Weaned calves group size ¹		group (2)	group (2-3)	group (3-4)	group (2-4)
	rearing days	330	110	225	30
Heifers	group size ¹	group (2-4)	group (9-13)	group (8-10)	group (10-15)
	rearing days	330	540	420	300
	group size ¹				group (14-20)
	rearing days				330

¹Numbers in parentheses were the number of cattle in same rearing area. It was checked at observation day.

Table 3 Time of routine work categorized into jobs

		Farm			
Job		A	B	C	D
		min · person/cattle/day			
Nursing calves	Feeding	5.1 ^a	2.7 ^a	20.2 ^b	13.2 ^c
	Cleaning	8.9 ^a	1.9 ^a	2.7 ^a	22.0 ^b
	Transfer	—	0.5 ^a	1.1 ^{ab}	2.0 ^b
Weaned calves and Heifers	Feeding	1.5 ^a	0.8 ^a	2.9 ^b	1.5 ^a
	Cleaning	1.3 ^a	0.8 ^a	9.2 ^b	7.4 ^b
	Transfer	6.1 ^a	0.4 ^b	—	0.3 ^b
total		10.5 ^a	2.7 ^b	13.9 ^c	11.8 ^{ac}

a, b, c: Means with different superscripts in same line differ significantly ($P < 0.05$).

In the stage after weaning, the working time of feeding in farm C was significantly ($P < 0.05$) longer than that in other farms. The time spent on cleaning work in farm A and B was significantly ($P < 0.05$) shorter than that in other farms.

The daily frequency of contacts during routine works, which were categorized by job, is shown in Figure 1. The contacts of the stockperson to the cattle were also classified by a type of contacts. Total frequency of contact during feeding was slightly lower than that in cattle transfer and the cleaning of the rearing pen. However, there was no significant difference.

Figure 2 shows the frequency of contacts during daily routine works, which were categorized by a

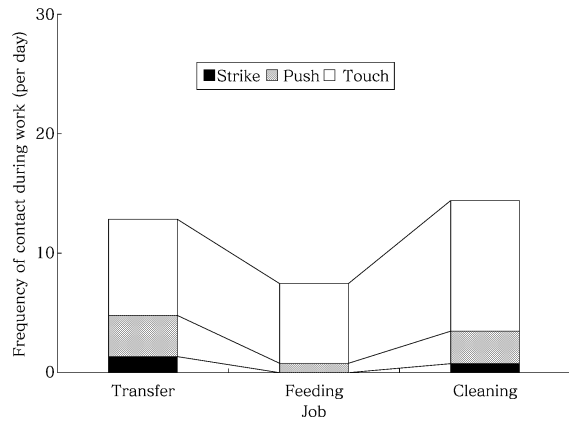


Figure 1 Frequency of contacts during daily routine works. Works were categorized into the type of jobs. Contacts were also categorized into touch, push and strike.

stockperson's position and the subject of their work. There was a clear difference of the number of contacts. The stockperson(s) gave 30.1 contacts during the inside work and about 6.3 times during the outside work. There was no contact during outside existence.

Table 4 shows cumulative time of routine work categorized by the working position. In the nursing period, the time spent on inside work in farm B and C was significantly ($P < 0.05$) shorter than that in farm A and D. In the period after weaning, time spent on inside work in farm B and D was significantly ($P < 0.05$) shorter than that in farm C. The outside work for calves in the nursing period was lowest in farm B, and that in the period after weaning was lowest in farm A.

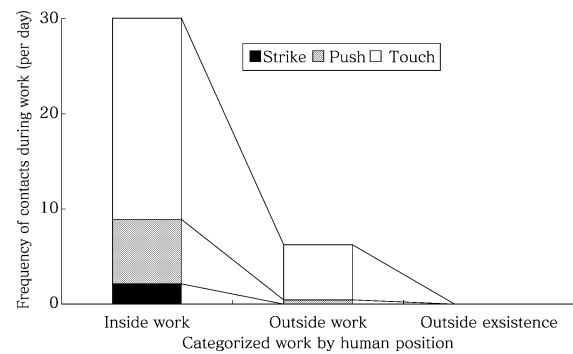


Figure 2 Frequency of contacts during daily routine works. Works were categorized by stockperson's position and the subject of work. Contacts were also categorized into touch, push and strike.

Table 4 Cumulative time¹ of routine work categorized by working position and subject of work

		Farm			
		A	B	C	D
		hours/cattle			
Nursing calves	Inside work	2.4 ^a	0.1 ^b	0.3 ^b	5.9 ^a
	Outside work	2.0 ^{ab}	0.7 ^b	3.0 ^a	2.6 ^{ab}
	Outside existence	19.0 ^b	20.3 ^b	28.7 ^b	95.5 ^a
Weaned calves and Heifers	Inside work	79.6 ^{ab}	5.9 ^b	109.0 ^a	17.8 ^b
	Outside work	5.9 ^c	46.8 ^{bc}	80.5 ^{ab}	127.4 ^a
	Outside existence	28.2	61.5	266.9	281.5
Total	Inside work	82.0 ^a	6.0 ^b	109.3 ^a	23.7 ^b
	Outside work	7.9 ^a	47.5 ^b	83.5 ^{bc}	130.0 ^a
	Outside existence	47.2	81.8	295.6	377.0

a, b, c: Means with different superscripts in same line differ significantly ($P < 0.05$).

¹Cumulative time of routine work was calculated from daily working time and rearing days in each stage

The outside existence had much variation in both periods. The farm that had the longest inside work did not always have longest outside work or outside existence in the both stages of the animal's life. From birth to first calving, the cattle got longer inside work than outside work in farm A and C. It was the reverse in farm B and D.

Averages of flight distance of cow rearing in four commercial dairy farms are shown in Figure 3. The average of flight distance was different in commercial dairy farms. The flight distance in B farm was significantly ($P < 0.05$) longer than other farms. The flight distance in A farm was shortest.

Table 5 shows the correlation coefficient between average of flight distance in each farm and natural logarithm of the cumulative time of routine work categorized to job or working position. There was no significant correlation in working time of job. The cumulative time of inside work of total period and after weaning period significantly ($P < 0.05$) correlated with flight distance. The correlation coefficient of the working time of inside work in nursing period and other working time categorized to outside

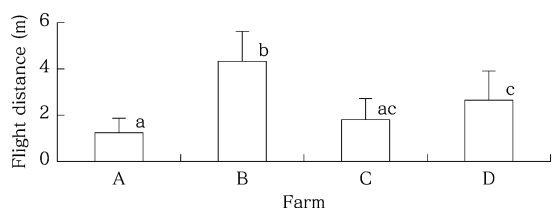


Figure 3 Average of flight distance of cow rearing in four commercial dairy farms. Horizontal bar indicates standard deviation. Different superscripts are significantly different ($P < 0.05$).

work and outside existence were not significant.

Discussion

On average, the frequency of contacts during work did not differ with the type of job, but differed with the work categorized by human position. On commercial farms, there were many variations of the position of facilities and rearing methods. For example, all calves in farm B and some calves in farm A were offered a milk replacer using a bucket without teat and the stockperson just put the bucket into the trough. So, the daily working time for feeding in the nursing stage was shortened rather than in the other farms. In farm B, it was quite a short time for inside work and outside work. This reduction of working time was a benefit for saving labor, but it caused less contact during routine work. In farm C and D, the milk-replacer was offered using bucket or bottle with teat and the stockperson held this bucket during feeding of milk-replacer. This work was counted to outside work for nursing calves rearing in farm C and D.

The hayrack in some pens on farm C was inside of the pens for heifers. So, the stockperson had to enter the pen for feeding the hay. The time spent for feeding per cattle in farm C in the stage after weaning was longer than other farms. The working efficiency of hay feeding was decreased by the hayrack position. On the other hand, inside work in farm C became longer in the stage after weaning. There were more contacts during inside work than outside work and outside existence. From the aspect of the frequency of human contact to animals, it was more frequent in such pens rather than the pen that had the hayrack outside.

On farm A and B, the stockperson moved

Table 5 Correlation coefficient between the average of flight distance (Y) in each farm and natural logarithm of cumulative time (X) of routine work categorized to job or working position.

	Job			Position		
	feeding	cleaning	transfer	Inside work	Outside work	Outside existence
Nursing calves	-0.639	-0.556	-	-0.578	-0.843	-0.011
Weaned calves and heifers	+0.516	+0.076	-0.696	-0.952*	+0.388	-0.013
Total	-0.355	-0.455	-0.696	-0.963*	+0.359	-0.046

Correlation coefficient with asterisk are significant ($P < 0.05$).

heifers from pen to pasture, and then the stockperson cleaned the heifer's pen. So the working time of the cleaning of the pen was shorter than that in other farms (farm C and D) and working efficiency was improved. In farm A and B, there was a contact during transfer work, but there was no contact during cleaning work. In farm A, the stockperson worked for cattle transfer for a longer time than on the other farms. This is one of the reasons why there was longer inside work in the stage after weaning in farm A than farm B and D. The time spent for transfer in farm B was shorter than that in farm A. In farm B, there was no contact during cleaning in the stage after weaning as described above. Also, the pen of heifer did not have an inside hayrack. These characteristics of facility positioning and rearing methods, and shorter working time in farm B were the cause of short inside work time that had a high contact level. It was concluded that human contact to animals during certain work was affected by the position of facilities and the rearing methods.

The average flight distance of cows in the four farms was different in the present study. Hemsworth and Barnett⁴⁾ showed that the average time to interact of pigs with a human was varied in the twelve farms. It is experientially known that an animal's reaction to human differs among commercial farms. Our results show that the reaction of cattle differed in dairy farms as in pig farms.

If the human animal relationship was built by cumulating of routine work on commercial farms, the cumulative time of routine work during cattle's life should be important rather than daily working time for the human-animal interaction. In the present study, the average flight distance of cows in each dairy farm was reduced with an increase of cumulative time of inside work from birth to first calving. The work form outside of the pen and humans existing outside of pen for calves and heifers did not influence the flight distance of cows. The contact of humans to animals during inside work was more frequent than the other work classified with a working position. It was concluded that less inside work

(fewer contacts) during the younger age resulted in a poor relationship between the humans and cows in the dairy farm.

Hemsworth and Barnett⁴⁾ pointed that a pig's first approach to a human was earlier with pleasant contact, but was later with aversive contact. This result indicated that the quality of contact was also important to the human-animal relationship. In the present study, contacts were classified into strike, push and touch, and most of contact during the inside work was touch. Our classification was not pleasant or aversive, but touch might indicate a more gentle contact than a push or strike.

The frequency of contact was only measured during work in the present study. The animals were not given only contact, but also other stimuli such as visual, auditory or olfactory during routine rearing work. The stimuli were not evaluated in the work classified as human position in the present study. Further studies containing the measurement of the other stimuli are need for the verification of evaluating the routine work.

The cumulative time of inside work in the period after weaning was affected, but the time of inside work in the nursing period did not affect the human-animal relationship of cows in a commercial dairy farm. The cumulative time of routine work was affected by the number of days of the rearing period in each stage and the daily working time for the cattle. It was already described that the daily working time was affected by the position of the facilities and rearing method. The daily time of work was longer in the nursing stage than that in the stage after weaning. However, the period of nursing was 60-75 days in a farm and the period was shorter than the period after weaning. The inside work during the nursing might have had few effects on the total time of inside work during cattle's life because the nursing period was shorter.

Some studies reported that the timing of optional contact or work also affected human-animal relationship^{1,2)}. Kosako and Imura⁷⁾ showed the chance to encounter humans during early stages facilitated the reaction of cattle to caretakers. Jago *et al.*⁶⁾ suggested that handling

in the first 2 days after birth was very important in the development of the subsequent interactions between humans and cattle. In the present study, we measured the flight distance of cows reared in farms, and we did not measure the reaction of calves and heifers. Therefore, we do not know the changes in the human-animal relationship with regard to the growth of calves on each farm. Further studies are needed to make clear the effects of the timing of routine work on the human-animal relationship in a commercial dairy farm.

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要 約

本研究では、酪農現場における哺育・育成期での管理作業を調べ、作業者の位置に基づく管理作業の評価を試み、同じ農場で飼養されている経産牛の逃走距離との関係を調べた。4戸の酪農現場を調査対象とした。各農家ごとに哺育・育成牛が飼養されている作業区域内での全管理作業を、各農家6回ずつ、8ミリビデオカメラで撮影した。あわせて、経産牛の逃走距離を4回ずつ測定した。作業を給飼、掃除、および牛の移動の3作業型にあてはめた。これとは別に、作業者の管理作業時の位置ごとに管理作業を、柵内、柵越および柵外作業に3区分した。総接触回数は、各作業型間に大きな差はみられなかった。これに対し、作業者の位置により分類された柵内作業において柵越作業に比べ、総接触回数が多いことが示された。農家ごとの経産牛における平均逃走距離と離乳後および哺育・育成期間を通じた累積柵内作業時間の間に負の相関が認められた。以上のように哺育・育成時の管理作業を、作業者の位置から解析することにより人間の接触を含めた管理作業の分類を行うことができ、人と牛との親和性の検討に用いることができると考えた。