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Choice of feeding position of dairy cows in free-stall barn

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Abstract

The objective of this experiment was to examine the preference for feeding position of cows under a free-stall housing system and to discuss the relationship between that preference and the layout of the feeding area or cow-movement within such a free-stall barn. Sixteen milking cows of the Holstein-Friesian / Friesian-Holstein breed were housed in a free-stall barn. Concentrate was fed from one feeding station equipped with an identification system and the cows were offered roughage *ad libitum* from 8 roughage troughs. The cows entered the feeding area in the barn after being milked. When from 2 to 8 cows were present at the feeding troughs, all the distances between the cows were calculated. The rate at six or more of cows ate simultaneously at the row of roughage troughs occupied only about 7% of the total daily eating time. When only one cow or two cows ate simultaneously, they preferred to eat at an end of the row feeding trough rather than one at the center. It was concluded that the choice of roughage eating position by cows is affected by the positioning of the concentrate feeding station and the movement of cows within a free-stall barn (e.g. passage position between stall and feeding area and entrance direction after milking).

Introduction

In determining the number and length of feeding troughs, the period of feeding trough occupation and the maximum number of simultaneously eating cows are basic data. Some papers have dealt with the relationship between the number of rearing animals and troughs in a feeding area[7,9]. And also, some papers have pointed out that feeding space per cow affected feed intake[5]. The effect of dominance relationships on the

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amount of time spent eating or occupying a feeding trough, the amount of feed intake, priority of access and level of aggression at feeding troughs have all been studied [1,2,3,9,10].

However, these results are only viable under conditions where cows are not permitted choice of feeding trough position. If cows are to be allowed preference of feeding trough, supplementary data becomes necessary in designing feeding areas. In a free-stall barn system, the traffic of cows is basically free. Thus, preference of feeding trough might be affected by the course of traffic in the barn, even though there is no difference in quality or quantity of ration in the trough. Furthermore, the spacing pattern created by preference of feeding trough is related to dominance relationship[8]. Therefore, cows distribute themselves in a non-random way. Such supplementary data have to be added the basic data (period of feeding trough occupation and number of simultaneously feeding cows) in order to facilitate the process of cattle housing design.

The objective of this experiment was to examine the preference for feeding position of cows kept under a free-stall housing system and to discuss the relationship between that preference and the layout of the feeding area or cow-movement within such a free-stall barn.

Materials and Methods

Sixteen milking cows of the Holstein-Friesian / Friesian-Holstein breed were housed in a free-stall barn. All the cows were in the first half of lactation and 8 were primiparous. Concentrate and roughage were offered separately. Concentrate was fed from one feeding station equipped with an identification system. The amount of concentrate offered depended on the individual milk yield (average daily quantity was 10 kg/cow). The maximum concentrate supply per one visit was 3.5 kg. Cows were offered roughage (mixture of maize and grass silage, 40% dry matter) *ad libitum* from roughage troughs (width = 90 cm) under an automatic intake recording (amount and period of occupation) and identification system[6]. Five days data of roughage trough occupation were used for analysis. Milking was conducted two times per day in a milking parlor.

The design and traffic of cow movement in the free-stall barn is shown in Figure 1. There were 8 feeding troughs for roughage. Water was supplied without restriction from two water troughs placed, one at each end, the row of roughage troughs. At milking time (morning and evening) the cows were led from the stall area to a milking parlor set apart from the free-stall barn. After milking, the cows entered the feeding area of the barn. Traffic in the barn was not restricted except at milking time.

The number of cows present at the roughage trough during observations varied from 1 to 8. As the number would affect predicted distances between them, records for different numbers of cows were treated separately. When from 2 to 8 cows were present at the feeding troughs, all distances between cows were calculated. (A distance of 1 indicated that cows were feeding adjacent to each other, a distance of 2 indicated that they were separated by one feeding position and so on.)

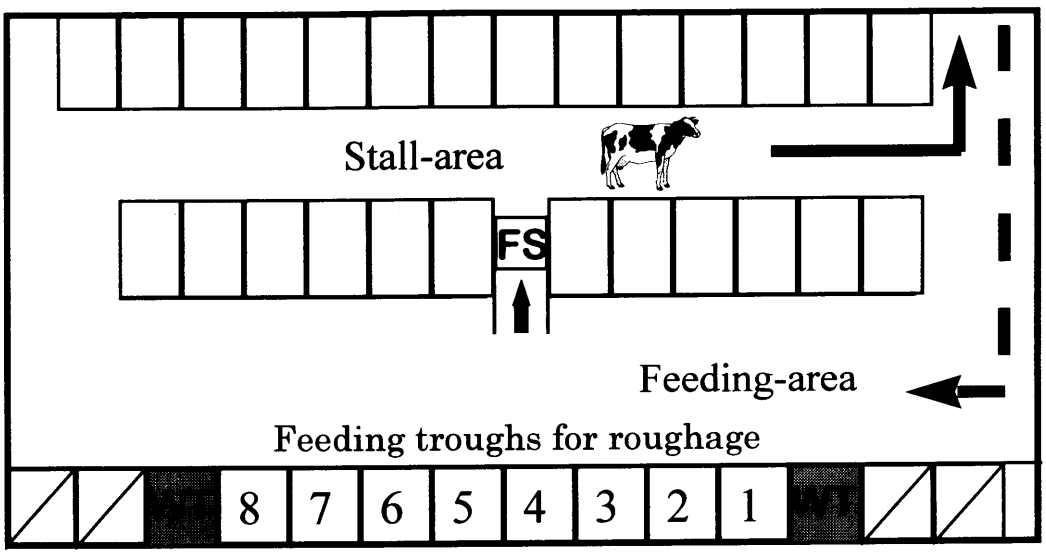

Figure 1. Design and cow movement in free-stall barn. There were 8 roughage troughs and 2 water troughs. Water troughs(WT) were placed at either ends of the row of roughage troughs. Concentrate was offered from one feeding station(FS) situated directly across from the roughage troughs. Cows moved to milking-parlor from stall-area➡, and after milking, cows entered feeding area of barn▬➡.

Results

Figure 2 shows the frequency distribution for simultaneously eating cows at the roughage feeding troughs. About 20% of total daily eating time was taken up with cows eating alone. The maximum rate for several simultaneously eating was 2 occupying about 30%. The rate for 6 or more cows eating simultaneously (6, 7, 8 cows) at the row of roughage troughs occupied only about 7% of total daily eating time.

Figure 3 shows the frequency distribution for choice of feeding position. For only 1 cow, or 2 cows eating simultaneously, the observed frequency for choice of roughage trough position was significantly different from that predicted. With two, they preferred to eat at the end feeding troughs rather than in the middle. There were no differences between the observed and predicted frequencies for over 3 cows eating simultaneously.

Figure 4 shows the observed frequencies for the distances between simultaneously eating cows with random distribution. With 2 cows eating, the cows distribute in non-random way, and the observed frequencies for distances one, five and seven were higher, and for distances three and four were lower than predicted. There were no differences between the observed and predicted frequencies for more than 3 cows eating simultaneously.

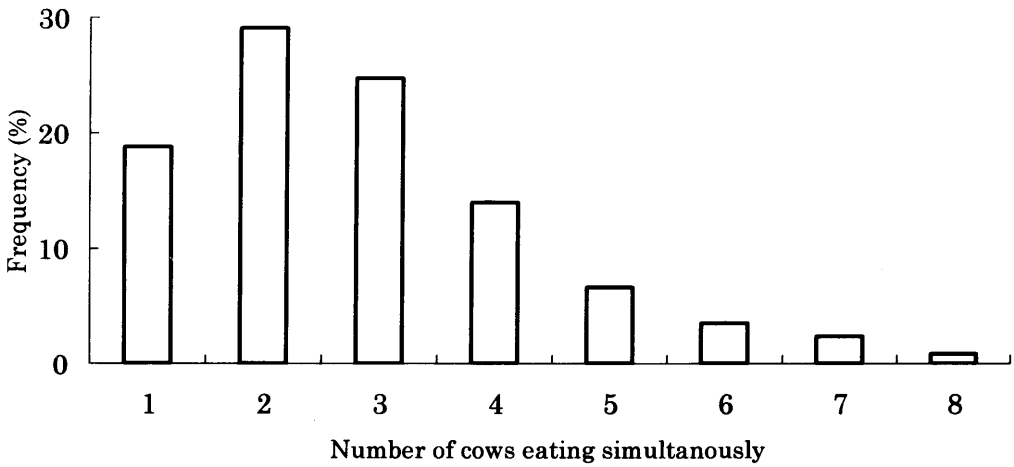

Figure 2. Frequency distribution for number of cows eating simultaneously eation cows at roughage troughs.

Discussion

From the present results on the numerical distribution of simultaneously eating cows, it is suggested that 8 troughs for 16 cows is sufficient as the rate for full occupation (8 cows eating simultaneously) was quite low. However, Metz[9] has indicated that the mean frequency for the chasing of herdmate away from the feedrack of hay and from the idling area beyond the rack was increased when the number of feeding places was decreased from 17 to 6 for 17 heifers. In the present experiment, we did not observe the chasing behavior of the cows at the feeding trough. If competition at the feeding troughs did increase, 8 troughs for 16 cows would not be recommended as a guideline for the design of feeding areas, in spite of the quite low frequency for 8 cows eating simultaneously in the present experiment.

In the situation where either only one, or two cows were eating simultaneously, partiality was shown in the preference of feeding trough. In either eating situation, they preferred to eat at end troughs rather than those situated in the middle. At both ends of the stall-area, there were passages for gaining access to the feeding area. When the cows entered the feeding area from the stall area via these passages, they approach the end troughs of the first. The feeding station for concentrate was situated directly across from the center trough of the row.

Sometimes, when waiting to eat concentrate, the cows crowded around the feeding station. It was concluded that the choice of roughage eating position was affected by the positioning of the concentrate feeding station and the passage between the stall and feeding areas.

The diurnal eating pattern of cows kept in a free-stall barn is affected by milking time, and rate of dry matter intake is higher just after milking[4]. After milking, the cows entered the feeding area via the passage along side trough No. 1 in the present experiment. This restriction of rout only occurred two times per day.

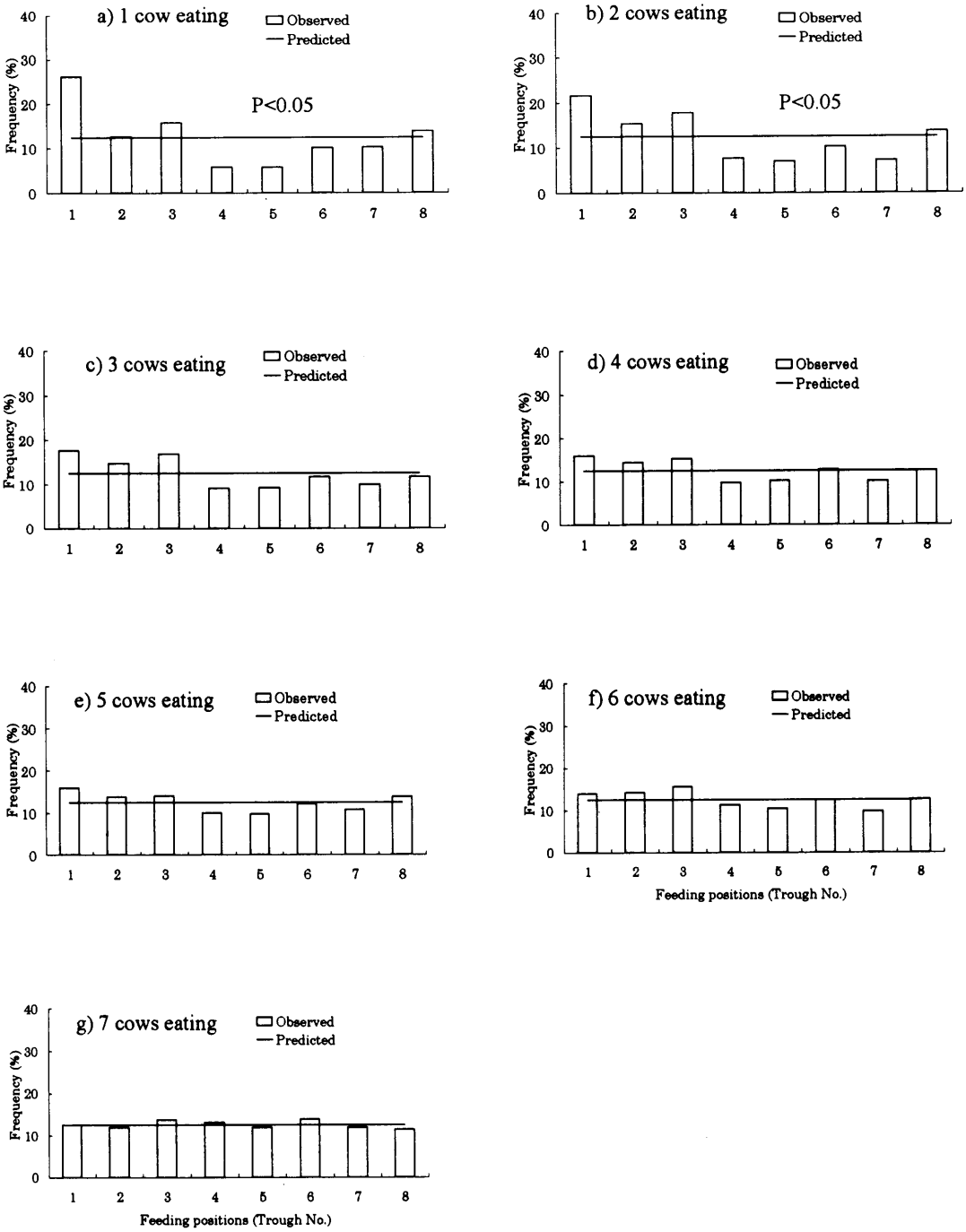

Figure 3. Frequency distibution for choice of feeding trough when cows ate roughage alone simultaneously (from two to seven cows eating at same time). Significant differences between observed and predicted distribution are indicated by $P<0.05$.

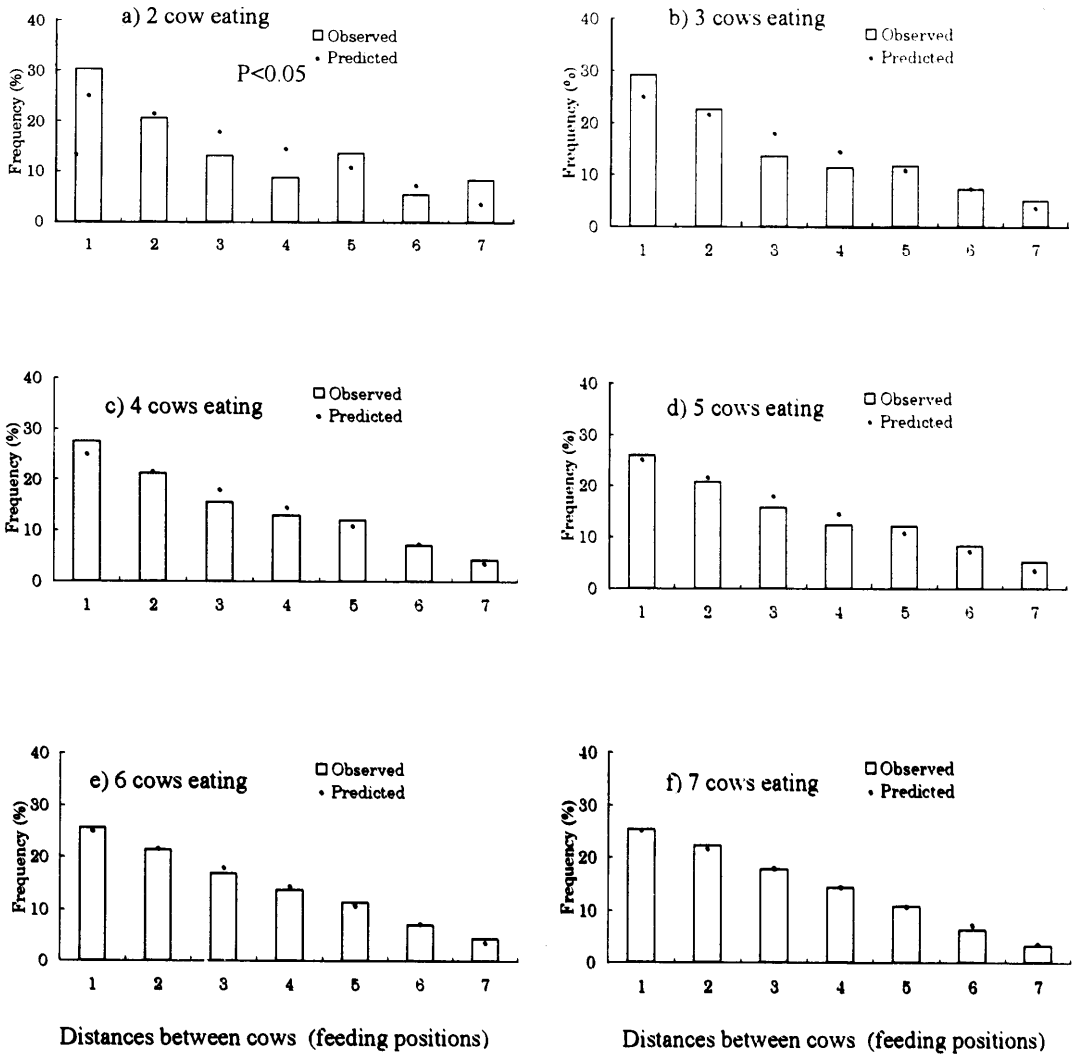

Figure 4. Frequency distributions for observed distance between simultaneous eating cows with predicted distance when cows distribute ramdomly. Significant difference observed and predicted distribution is indicated by $P < 0.05$.

However, comparing the end troughs, a preference was shown for trough No. 1. It was noted that the rout from the milking parlor to the feeding area after milking also affected the choice of feeding trough cows.

Manson and Appleby[8] concluded that the spacing pattern in feeding trough preference was related to dominance relationships. In the present experiment, when 2 cows ate roughage simultaneously, they distributed themselves in a non-random way, and the observed frequency for distance one was higher than predicted. It appeared that familiarity had led some pairs of cows to seek proximity. In order to understand this

utilization of troughs, we have to take into account the spacing pattern for each pair of cows, including dominance their values. However, we had no data regarding their hierarchy, and we did not analyze the difference in distances between each pair. Further research focused on this point is necessary in examining the choice of feeding troughs from the aspects of relationships between cows.

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要　約

本試験では，16頭の搾乳牛を用い，フリーストール牛舎における乳牛の採食位置選択性を検討した。搾乳は，朝と夕の1日2回，ミルキングパーラにて行った。粗飼料は，8台の個体認識装置付き飼槽で給与し，自由採食させた。濃厚飼料は，粗飼料の給与エリアに設置した1台の濃厚飼料自動給与装置にて，個体別に給与した。各飼槽における占有牛の番号を連続して記録し，同時採食頭数，食時の個体間距離ならびに飼槽選択位置について解析した。6頭以上の同時採食割合の合計は，全体の7％程度であった。単独ならびに2頭同時採食時の，飼槽選択割合は，搾乳室からの退出経路に近い飼槽列端の飼槽で高く，濃厚飼料給与装置の反対側に位置する飼槽列中央部で低かった。これらのことから，フリーストール牛舎における乳牛の粗飼料飼槽の選択は均等ではなく，濃厚飼料給与装置の位置，ストールエリアから給飼エリアに乳牛が移動する際の通路位置ならびに搾乳終了後の牛舎への進入経路により影響を受けると結論した。