EFFECT OF HOUSING SYSTEMS ON BEHAVIOUR AND LAMENESS IN DAIRY COWS

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SUMMARY

This study was carried out to investigate the effect of different housing systems on behavioural patterns and incidence of lameness in dairy cows. Four private dairy farms of a total of 1800 dairy cows in Giza and Kalubia governorates were investigated for 3 months experimental period. The animals under study were housed in two different housing systems; the first was tied or cubicle house with concrete floor while the second was loose (yard) house with a dirty floor. The behavioural activities of these animals, including lying down, standing, feeding, rumination and locomotor behaviours were monitored, also the incidence of lameness between animals in both housing systems was recorded. The obtained results declared that:

1- The incidence of overall lameness (claw and leg lameness) was significantly higher between animals kept in cubicle (tied) house with concrete floor than between those kept in loose (yard) house with dirty floor.

2- The normal cows in loose dirty house spent significantly more time lying down and less time standing than those in cubicle house with concrete floor, while, lame cows in both housing types spent more time lying down and less time standing than normal cows.

3- Cows in the loose dirty house went more frequently to food but spent less time feeding than those kept in cubicle house and the lame cow in both systems spent less time feeding the normal cows.

4- A slight difference in total ruminating time due to housing system was recorded while the lame cows spent a significant longer ruminating time while lying down.

5- The locomotor behaviour of the lame cow was significantly slower in gait and movement than normal cows. The lame cow performs a characteristic posture considered to a large extent as an indicator for claw or leg lameness.
INTRODUCTION

Informations concerning animal behaviour is helpful in terms of both welfare and productivity, because changes in behaviour are the means by which animals adapt to their environment (Broom, 1986) or physiological state. The welfare of an individual is its state as regards its attempts to cope with its environment. Coping can sometimes be achieved with little effort and expenditure of resources or it may fail to cope at all, in which case its welfare is obviously poor. One approach to the improvement of welfare lies in the design of "housing systems" on the basis of either what animal chooses to do (Fraser and Broom, 1990).

Housing in dairy cattle is under our climatic conditions, a necessary infringement in the animal's life. Concentration of animals in confined areas during long periods can adversely influence health and behaviour. Furthermore, cattle keepers continue to look for labour- and cost-saving designs. A careful evaluation of total housing system design and of construction details is necessary, both from an economical point of view and from the view point of animal welfare (Health and behaviour), (Wierenga and Peterse, 1987). The flooring of the intensive house constitutes one of the major problems in the animal welfare field. Many welfarists insist that the best or indeed the only acceptable type of flooring is a bed of straw or similar type of material corresponding more or less with the natural surface most animals would lie on (Maton, 1987 and Watthes and Charles, 1994).

Lameness is an example of an effect of housing (Wierenga and Peterse, 1987) which causes economical losses for the farmers and which affects the well-being of the animal adversely. Lameness results in a deterioration of the well-being of the animals because of the subsequent pain, reduced food intake and loss of body conditions, and because it interferes with the animal's behaviour such lying and locomotor behaviour (Hemsworth et al., 1995). Consequently, lameness can be considered as a serious welfare problem for dairy cows (Manson and Leaver, 1989).

The present study was planned to investigate the effects of different housing conditions and flooring type on the behaviour of dairy cows through comparing the behaviour of normal and lame cows in both cubicle and loose (dirty or straw yard) housing systems, and also to study the effect of housing on the incidence of lameness in both types of housing system.

MATERIAL AND METHODS

I- Animals and location:

Four private farms of a total of 1800 dairy cows (the breeds of cows were mostly Friesian) were included, investigated and observed from april to August, 1996 for completion of this study. Three farms of them were in Giza governorate (Tonsy "A" contains 1100 cows; Pyramid "B" contains 320 cows and Kaffr-Hakim "C" contains

185 cows) and the fourth one was in Kalubia governorate (Shobra-Shehab "D" contains 195 cows).

2- Management:

2.1. Housing:

Two housing systems were investigated in the study. The first was closed (Tid or cubicile) house system (C and D farms), in this system the animals were kept in rows on a concrete floor, each animal was tied in a separate cubicile and sometimes the floor covered with rice straw. The second house system was the loose (Yard) system (A and B farms), in which the animals were kept free and the floor was dirty floor and sometimes straw floor in winter.

2.2. The cows in both housing systems were fed to a large extent the same diet, the concentrates were offered with grass to the animals twice per day either in the food manger in cubicile house or under the shed in the loose house.

2.3. Identification of animals:

Random sample of cows under study of 10% in the small herd (C and D farms) and 1% of large farms (A and B) were identified in each farm for the behavioural patterns observation (Albright and Timmons, 1984).

In the tied (cubicile) house, the animals were identified using the fixed ear tag numbers and also the cubicile numbers (Fraser and Broom, 1990). While the animals in the loose house were identified using colour marks other than the own colour of the cow on the back, side of the neck and on the forehead (Bazeley and Pincsent, 1984).

3- Observation and records:

3.1. Behavioural patterns observation:

The following behavioural patterns related to the housing system and lameness (Singh et al., 1993) were observed and recorded for the normal and lame cows in each farm. The observation times were twice per day in a factorial arrangement from (08.00 to 10.00 a.m.) and from (03.00 to 05.00 p.m). Each farm was observed one day per week for 3 months of a total observation time of 180 minutes per day (90 min. for the normal identified cows and 90 min. for the lame cows), (Potter and Broom, 1986).

3.1.1. Lying down and standing behaviour:

The time spent lying down and time spent standing by the dairy cow (normal and lame cows) were observed and recorded during 15 minutes observation. The standing animal was also observed if it stands in the cubicile or half-in a cubicile or in the alley passage (Arave and Walters, 1980).

3.1.2. Feeding behaviour:

The time spent feeding and the rate (frequency) of feeding for both normal and lame cows were observed and recorded during 10 minutes observation according to Baxter, (1983).
3.1.3. Ruminating behaviour:

During a period of 10 minutes observation, the time spent ruminating while standing, and time spent ruminating while lying down and the total time spent ruminating were observed and recorded for both normal and lame cows in each of the tied and loose housing system (Clackson and ward, 1991).

3.1.4. Locomotor behaviour:

According to Leaver, (1988), the movements (gait) of the normal and lame cows were observed and described, also the posture of animals especially the lame animals was observed during 10 minutes observation period.

3.2. The incidence of lameness:

Data on lameness (claw or leg lameness) incidence for each herd was from forms filled in by the stockman or veterinarian whenever the movement of the animal or a foot was lifted up for treatment or examination. The overall incidence of lameness was calculated in percentage for each herd (farm) according to the following equation (Beresh, 1990).

\[
\% \text{ of lameness incidence} = \frac{\text{No. of the affected animals}}{\text{Total number of the animals}} \times 100
\]

4- Statistical analysis:

The collected data for behavioural patterns and incidence of lameness were subjected to statistical analysis using ANOVA according to Snedecor and Cochran (1989) to investigate the significance of the effect of the housing system on behaviour and lameness in dairy cows.

RESULTS

Table (1): Behavioural patterns of dairy cows under different housing systems

<table>
<thead>
<tr>
<th>Housing type</th>
<th>Cubicle (tied) house</th>
<th>Loose (yard) house</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Lame</td>
</tr>
<tr>
<td>Time spent lying down (min.)</td>
<td>5.11± 0.09abc</td>
<td>9.71± 0.13ab</td>
</tr>
<tr>
<td>Time spent standing (min.)</td>
<td>12.32± 1.1abc</td>
<td>3.53± 0.08ab</td>
</tr>
<tr>
<td>Frequency of feeding (No.)</td>
<td>3.11± 0.11ac</td>
<td>4.21± 0.1b</td>
</tr>
<tr>
<td>Time spent feeding (min.)</td>
<td>10.12± 1.3abcd</td>
<td>7.62± 0.87abcd</td>
</tr>
<tr>
<td>Lying ruminating time (min.)</td>
<td>5.13± 0.03abd</td>
<td>8.11± 0.87ab</td>
</tr>
<tr>
<td>Standing ruminating time</td>
<td>7.92± 0.03abd</td>
<td>5.14±0.08abd</td>
</tr>
<tr>
<td>Total ruminating time (min.)</td>
<td>13.05± 1.02a</td>
<td>13.25± 1.12b</td>
</tr>
</tbody>
</table>

abcd = Mean values which have the same superscripts inside rows are significantly different at (P < 0.05)
Table (2): Incidence of lameness in relation to housing system in dairy cows:

<table>
<thead>
<tr>
<th>Farm No.</th>
<th>House type</th>
<th>Floor type</th>
<th>Total number of animals</th>
<th>No. of affected animals</th>
<th>Percentage of lameness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Loose</td>
<td>Dirty</td>
<td>1100</td>
<td>58</td>
<td>5.27%</td>
</tr>
<tr>
<td>B</td>
<td>Loose</td>
<td>Dirty</td>
<td>320</td>
<td>12</td>
<td>3.75%</td>
</tr>
<tr>
<td>C</td>
<td>Tied</td>
<td>Concrete</td>
<td>185</td>
<td>14</td>
<td>7.57%</td>
</tr>
<tr>
<td>D</td>
<td>Tied</td>
<td>Concrete</td>
<td>195</td>
<td>19</td>
<td>9.74%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1800</td>
<td>103</td>
<td>5.72%</td>
</tr>
</tbody>
</table>

DISCUSSION

Different housing conditions affect the behaviour of cattle which show preference for certain housing designs and types of bedding (Dewes, 1978; Potter and Broom, 1987; Jan Cermak, 1987; Wierenga and Hopster, 1990 and O’Connell et al., 1989 and 1991). Also lameness can affect the welfare of the animal through interfering with the normal behaviour of the animal (Singh et al., 1993a and 1994 and Leonard et al., 1994).

1- Lying down and standing behaviour:

Lying down is an important behaviour of dairy cows, factors such as type of housing, bedding, oestrus and lactation can affect the time spent lying down by the cows (Arave and Walters, 1980; Metz and Wierenga, 1984 and O’Connell et al., 1992). The dairy cows spent normally 9-12 h/day with an average of 9.7 h/day lying down (Wierenga and Hopster, 1990).

In this study, the normal cows in the cubicle concrete house spent significantly (P < 0.05) less time lying down (5.11 ± 0.09 min.) and more time standing (12.32 ± 1.1 min.) than those kept in the loose dirty house (9.71 ± 0.13 and 3.53 ± 0.08, respectively). The longer time spent standing by the normal cows in the cubicle house may be due to the fact that, the concrete floor is hard surface and considered as uncomfortable place for lying down. On the other hind, the lame cows in both housing types spent significantly (P < 0.05) more time lying down (9.71 ± 0.13 min.and 10.24 ± 0.72 min) and less time standing (3.53 ± 0.08 and 4.91 ± 0.13 min.) than the normal cows (5.11 ± 0.09 & 7.92 ± 0.11 min. for lying down and 12.32 ± 1.1 & 10.23 ± 1.2 min. for standing) for cubicle and loose house, respectively. The longer time
spent lying down by the lame cows suggesting that, the lame cow lay down to reduce the pressure on their affected feet and alleviate the pain. The results agree with Hassall et al. (1993); Singh et al. (1993b) and Leonard et al. (1994).

2- Feeding behaviour:

It was reported that, the lameness affect adversely the feeding behaviour of dairy cow (Singh et al., 1993a). In this study, it was observed that, the normal cows in loose house system went more frequently (6.13 ± 0.53) and spent less time feeding (7.11 ± 1.0 min.) than normal cows housed in the cubicle house (3.11 ± 0.11 and 10.12 ± 1.3 min., respectively); this may be due to cows in loose house kept free and socially facilitated during feeding and consequently the aggregation and competition of animals around food troughs leading the cow spent less time feeding.

The lame cow spent significantly (P < 0.05) less time feeding (7.62 ± 0.87 and 4.83 ± 0.33 min.) than the normal cows (10.12 ± 1.3 and 7.11 ± 1.0 min) in both cubicle and loose housing systems, respectively; and this may be attributed to the pain accompanied lameness. Results agree with (Friend and Polen, 1974; Friend et al., 1977; Jan Cermak, 1987 and Manson and Leaver, 1989) and disagree with Singh et al., (1993b) who noticed that there was no difference in feeding time between groups housed in cubicle and those housed in loose house.

3- Rumination behaviour:

Rumination is a physiological process in cattle (Singh et al., 1994). Generally in this study there was no significant difference in total rumination time due to housing type. The normal cows in loose house spent significantly (P < 0.05) longer lying rumination time (8.81 ± 0.87 min.) and less standing ruminating time (5.13 ± 0.14 min.) than the normal ones kept in cubicle house (5.13 ± 0.03 and 7.92 ± 0.03 min, respectively).

Also the lame cows spent significantly (P < 0.05) longer time ruminating while lying (8.11 ± 0.87 & 12.37 ± 1.2 min.) and less time ruminating while standing (5.14 ± 0.08 & 2.11 ± 0.01 min.) than the normal cows (5.13 ± 0.03 & 8.81 ± 1.0 and 7.92 ± 0.03 & 5.13 ± 0.14 min. for lying and standing ruminating, respectively) in both cubicle and loose house types, respectively; this may be suggesting that, the lame cows lay down to reduce the pressure on their feet. The obtained results agree to some extent with Cramer et al. (1974); Potter and Broom (1986); Manson and Leaver (1989); Clackson and Ward (1991) and Singh et al. (1993b).

4- Locomotor behaviour:

Zeeb (1987) mentioned that, the locomotion of the animal is considered as the most important behaviour for diagnosis of claw disorders in dairy cattle. The results obtained (table 1) declared that, there was no significant difference in locomotor behaviour due to housing type, but the difference was significant between normal and lame cows; as

the movement and gait of the lame cows were significantly more restricted and slower (+) that those of the normal ones (+++) which may be due to the pain associated with the lameness.

It was observed also that, the lame cows entered the milking parlour later than the normal cows. Observation also declared that, the lame cows perform a characteristic abnormal posture while standing especially in the cubicle house, an arched back, frequently paddling and lifting their feet, shifiting their weight on their hind feet. Some cows stood half-in the cubicle and rested one foot in the cubicle while keeping the other in the passage and others stretched their body with their hind feet in the passage and front ones in the cubicle.

The observations agree with (Dewes, 1978; Wierenga, 1983; Kempkens and Boxberger, 1987; Zeeb, 1987; and Hassall et al., 1993).

5- Incidence of Lameness:

The previous studies reported an association between housing and lameness (Baggott and Russell, 1981; Rowlands et al., 1983; Thyaen, 1987). As shown in table (2) the incidence of lameness (leg or claw) was significantly (P <0.05) higher between cows housed in cubicle house with concrete floor (7.57% and 9.74% for farm C and D, respectively with an average of 8.66%) than between those kept in the loose dirty house (5.27% and 3.75% for farms A and B, respectively with an average of 4.51%). The overall incidence of lameness during this study was 5.72% and this is considered as a welfare problem especially for animals kept in concrete cubicle house system.

The high incidence of lameness in the concrete cubicle house may by attributed to; 1- The cows in the cubicle spent longer time standing than those kept in loose house (Table 1), this causes a disturbance in microvasculature of the corium resulting in the escape of the blood components to the tubules of the horn of the sole and bulbs, consequently haemorrhagic events associated with subclinical laminitis which causes lameness (Greenough and Vermunt, 1991) or 2- In case of bad management, the cow's claw in the cubicle concrete floor is exposed to the own excreta (urine and faeces) of the animal for long time resulting in absorption of water in the claw horn causing its softness resulting in decrease of its resistance to microbial agents leading to different pathological conditions which finally cause lameness (Singh et al., 1993b).

Results recorded agree with Whitaker et al. (1983); Bazeley and Pinsent, (1984); Rowlands et al. (1985); Greenough and Vermunt (1991) and with Leonard et al. (1994) who observed a moderate correlation between the lying down behaviour and the total foot lesion as cows spent less time lying down and more time standing had a higher incidence of foot lesions.

It can be concluded that, housing on concrete has a deleterious effect on claw health manifested by

lameness which can be seen as the behavioural expression of claw and leg disorders based on pain which may induce an abnormal gait and behaviour, so loose dirty house (yards) are better in encouraging cows to lie down and in providing a soft and dry surface for standing, this may be helpful in minimizing of lameness and improving animal welfare.

REFERENCES


