

Failure to Use Cubicles and Concentrate Dispenser by Heifers after Transfer from Rearing Accommodation to Milking Herd

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Kjæstad HP, Myren HJ: Failure to use cubicles and concentrate dispenser by heifers after transfer from rearing accommodation to milking herd. Acta vet. Scand. 2001, 42, 171-180. – Thirty-three dairy farms in the Norwegian counties of Østfold and Akershus in which cubicle sheds had been in use for at least one year and with a herd size of less than 60 cows, were contacted and asked to participate in a study. The study focused on heifers' use of cubicles and concentrate dispenser just after being transferred from rearing accommodation to the milking herd. For each heifer, the farmer recorded cubicle use once nightly between 9 and 11 pm. The daily amount of concentrate released in the dispenser and the allotted daily ration were also recorded. The recording period was 15 consecutive days for cubicle use and 7 days for concentrate dispenser use. Cubicle refusal behaviour, i.e. lying outside the cubicles, was analysed by logistic regression using rearing accommodation of heifers, herd size, heifer age, and housing layout as independent variables, and herd as a clustering variable. On Day 2 after transfer, 34% of the heifers were showing cubicle refusal behaviour (N=340). By Day 15 this percentage had dropped to 23. Cubicle refusal was lower throughout the whole period among heifers which used the cubicles on the 3 first days after transfer compared to those which did not. This tendency could also be detected several months later. The analysis showed cubicle refusal to be significantly associated with rearing accommodation (OR=6.1, c.i._{95%}OR=1.5-24.3, P=0.01) and cubicle layout in the shed (OR=0.2, c.i._{95%}OR=0.0-0.7, P=0.01). None of the tested variables were found to be significant for failure to use the concentrate dispenser, a behaviour which was less frequent than cubicle refusal. However, 8 percent of the heifers did not visit the dispenser at all throughout the 7 days of observation.

dairy heifers; cubicle housing; cubicle refusal; rearing accommodation; concentrate feed dispenser.

Introduction

Non-confinement housing for dairy cows is more common than systems for individual tethering in many countries, e.g. the Netherlands and United Kingdom (Bøe 1993). Compared to the tie barn, the per-cow cost of so-called cubicle housing is relatively high for small herds. Even so, many herds are kept in such housing in Norway, where the average dairy herd size is

less than 20 cows (*Statistics Norway* 1996). The cubicle housing system not only allows better opportunity for the expression of many kinds of behaviour and in some respects provides a better working environment, some studies also indicate that such systems are favourable to both herd health and reproduction (Bakken *et al.* 1988, Ekesbo 1966, Østerås 1988, Valde *et al.*

1997). When existing tie barns are renovated, they are often converted into cubicle sheds (Valde *et al.* 1997).

Because of the relatively high cow culling rate in modern dairy production, replacement heifers are frequently introduced into the milking herd. From about one year of age the heifers are usually reared in pens with fully slatted floors. From this rearing accommodation they are transferred to the milking herd a certain time, usually about four weeks, before calving. After being transferred, the heifers will have to interact with their new herd mates, most of which have a higher social status due to a greater body size and higher age (Fraser & Broom 1990). Furthermore, the heifers have to learn how to use a number of new physical facilities which are not usually present inside their rearing accommodation, such as the cubicles (individual resting places) and the concentrate feed dispenser.

Heifers as well as some cows may be reluctant to use the cubicles and prefer to lie down in the walking area (hereafter referred to as *cubicle refusal*) when resting (Kjæstad & Myren 2001). In a study of cubicle refusal in cubicle sheds during the last week before calving, it was found that 29% of the heifers refused to lie in the cubicles compared with only 3% of older cows (Kjæstad & Simensen 2001). Among the consequences of lying on the slatted floor are soiling and chilling of the udder. Both faecal soiling and chilling are known mastitis risk factors. Furthermore, cows lying in the walking areas may hinder the movement of their herd mates.

It is generally recognised that gradually increasing concentrate intake during late pregnancy is important for proper ruminal adaptation to the relatively high concentrate intake needed to sustain peak lactation. Failure to use the concentrate dispenser may therefore result in a disturbance of this process.

On this background, a study was undertaken aiming to:

- Describe the use of cubicles for resting during the first days after transfer of heifers into the milking herd
- investigate the effects of the following housing variables; herd size, rearing accommodation and cubicle shed layout, upon the heifers' use of cubicles
- describe and analyse the heifers' use of the concentrate feed dispenser, employing an approach similar to that for cubicle use.

Materials and methods

All dairy farms with cubicle sheds in the counties Østfold and Akershus in 1989 were identified with the help of the regional agricultural authorities. The counties of Østfold and Akershus were chosen because of accessibility and because they were known to have a number of dairy herds in cubicle sheds of various sizes. To prevent data from unusually large herds from influencing the study, an upper limit of 60 cows per herd was set as an additional inclusion criterion. The final criterion was that the cowshed must have been in use for at least one year, so as to avoid collecting data from herds with problems particularly related to starting up.

Forty-one of the 49 farmers identified agreed to participate in the study. The participating herds were visited at the start of the study, and recordings were made of the following herd variables:

- Cubicle shed layout. The sheds were assigned to one of 3 categories according to the layout of the cubicles: sheds with a single row of cubicles facing an outer wall were designated as "Type 1", those with a double row of cubicles facing each other in the middle of the pen, and those with a passageway at both ends of the double row were designated as "Type 2", while all other designs were designated as "Type 3" (Fig. 1).

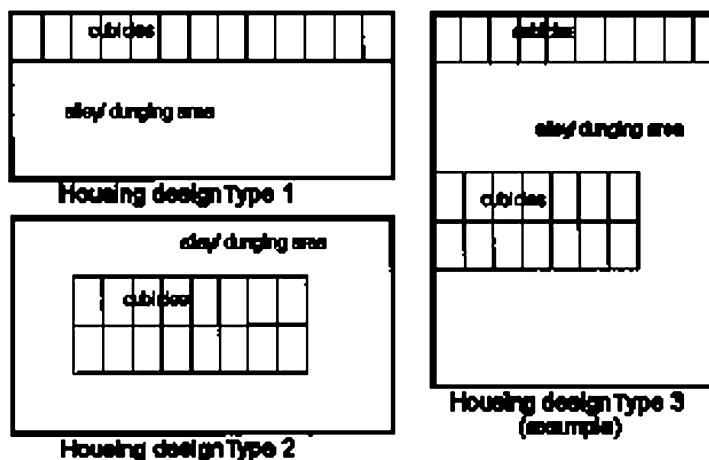


Figure 1. Housing design types.

Furthermore, the farmer was instructed to record data on:

- Type of rearing accommodation in the period from insemination until transfer (tethered, slatted floor pen, slatted floor pen with cubicles, pasture, other)
- total number of heifers and cows in the cubicle shed.

The farmers were also instructed to record whether the heifers were lying or standing once nightly for the first 15 nights after transfer into the dairy herd. The observations were made between 9 and 11 pm, and cubicle use was classified according to the following criteria:

- Lying outside a cubicle (fully or partly)
- standing outside a cubicle
- lying inside a cubicle
- standing inside a cubicle.

The farmers recorded information from the concentrate dispenser control unit for the first seven days after transfer of the heifer into the dairy herd. The recordings concerned:

- The daily allotted individual ration
- the daily amount actually released by the individual heifer.

The farmers were also requested to state the heifer's general habit or inclination with regard to cubicle use at 2 weeks after transfer into the dairy herd, immediately after calving, 2 months after calving and 6 months after calving (cubicle, alley, or inconsistent choice of lying place). The introduction of heifers into the milking herd was to take place according to the practice normally employed in the respective farms, with one explicit exception: There was to be no special guiding or enticing of heifers to make them enter the cubicles or feed station.

Of the 41 participating farmers, 33 provided the requested information. Data were collected on 385 heifers from these herds. Most data forms were fairly complete, although some observations were lacking, most notably concerning the behaviour variables towards the last days of observation.

The mean number of cows and heifers in the cubicle sheds was 23.6 (range 10–44). Ten of the cubicle sheds belonged to Type 1, 12 to Type 2 and 11 to Type 3. All sheds had slatted floors in the alley/dunging area. Information on rearing environment was provided for 340 heifers.

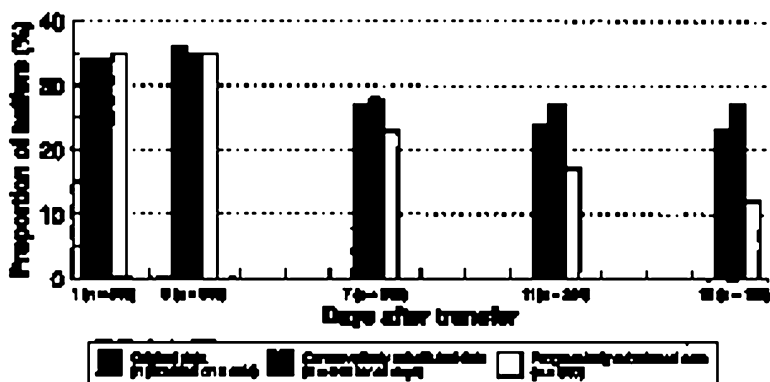


Figure 2. Cubicle refusal by heifers after transfer to the dairy herd.

Most of them (54%) were reared in fully slatted pens.

On Day 1, the heifers were allotted a median daily ration of 1.0 kg concentrate (range 0.1-7.0 kg) from the dispensers, this information being available for 291 heifers. The feed was distributed in smaller subdivisions fed throughout the day according to a programming schedule which varied from farm to farm.

Statistics

Description of cubicle and feed dispenser use after transfer into the dairy herd was done by calculating the proportions of the respective behaviour categories for each day after transfer, the total consisting of the sum of all observations of that day.

Cubicle refusal on Day 2 after transfer, as well as failure to use the feed dispenser on Day 2 were subjected to a logistic regression analysis for distinguishable data with herd as a random effects variable (*Statistics and Epidemiology Research Corporation 1991*).

The analysis of cubicle refusal (abbreviated CUBREF2) included the following independent variables:

- Rearing heifer in a fully slatted floor pen (SLATS, the value 1 denoting slatted floor

- pen, 0 denoting any other accommodation)

- number of heifers and cows in the milking herd (HESIZE)

- cubicle shed layout Type 1 (TYPE1, the value "1" denoting sheds of Type 1, "0" other types)

- cubicle shed layout Type 2 (TYPE2, "1" denoting Type2, "0" other types, meaning that when TYPE1 and TYPE2 both had the value "0", the shed was a Type 3 shed),

this providing the initial model $CUBREF2 = a + b_1SLATS + b_2HESIZE + b_3TYPE1 + b_4TYPE2$, b_n being the regression coefficient of variable number n, and a the regression constant (intercept).

The analysis of feed dispenser refusal (DISREF2) was analysed using a similar initial model, $DISREF2 = a + b_1SLATS + b_2HESIZE + b_3TYPE1 + b_4TYPE2$.

To illustrate the effect of missing values for these variables, 2 substituted data sets were created. A conservatively substituted set was made by carrying the last observation forward. For example, 30 missing observations for Day 5 were substituted with the observations from Day 4, thereby "increasing" the number of observations on Day 5 from 310 to 340. Another, progressively substituted, set was made by sub-

stituting e.g. the missing observations on Day 5 with observations from Day 6, thereby placing emphasis on the observations towards the end of the observation period. When all succeeding next values were also missing, the observation was designated as “lying in cubicle” by default.

Results

Cubicle use

Cubicle refusal by heifers was observed in 74% of the herds one day after the heifers were transferred to the cubicle-housed milking herd. At this time, 34% of the heifers were found to be showing cubicle refusal behaviour, while 29% were lying in the cubicles (the remaining 37% were standing at the time of recording). The proportion of heifers showing cubicle refusal decreased from 34% on Day 1 to 27% on Day 7 (Fig. 2). Correspondingly, observations of heifers lying in cubicles rose to about 50%. The proportion of animals showing cubicle refusal seemed to have settled by Day 7, and remained fairly constant from then on. On Day 15, 23% of the heifers were lying outside the cubicles, 52% were lying in the cubicles, and the remaining 25% were standing. The data substitution procedure gave similar results (Fig. 2).

The heifers could be further divided into 3

Table 1. Heifers' general cubicle use six months after calving in relation to cubicle use around the time of calving.

Around calving	n	Six months after calving	
		Cubicle use	Cubicle refusal
Cubicle use	150	146 (98%)	4 (1%)
Cubicle refusal	49	32 (65%)	17 (35%)

groups according to cubicle use the first 3 nights after transfer. There was one group of heifers which used the cubicles every night the 3 first nights, and generally they continued doing so (Fig. 3). The heifers in the second group did not use cubicles on any of the 3 first nights, and were found to show the lowest level of cubicle use throughout the 15-day observation period. The heifers in the third group, which were found to use the cubicles one or 2 nights out of the first 3 nights, continued using the cubicles less frequently than the heifers in the first group, but more frequently than those in the second group (Fig. 3).

The observations on cubicle use beyond the 15-day monitoring showed that 35% of the heifers showing cubicle refusal around calving were still doing so 6 months later (Table 1).

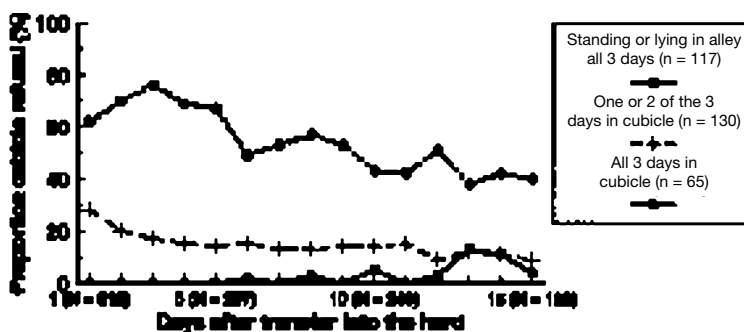


Figure 3. Cubicle refusal the first 15 days after transfer into the dairy herd, related to cubicle use the first 3 days.

Table 2. Results of logistic regression analysis of cubicle refusal by heifers on day 2 after inclusion into the dairy herd.

Model: $CUBREF = a + b_1SLATS + b_2TYPE2$, b_n being the regression coefficient of variable number n
 N = 254 (131 heifer records had missing observations for one or more of the analysed variables)

Regression term	Explanation	Regression coefficient	Odds ratio	c.i. _{.95%OR}	p
a	Regression constant (intercept)	- 1.2	-	-	0.12
SLATS	Rearing accommodation of the heifer (1 = fully slatted floor pen, 0 = other accommodation)	1.8	6.1	1.5-24.3	0.01
TYPE2	Cubicles arranged as one double row of cubicles facing each other. Passageways at both ends.	- 1.9	0.2	0.0-0.7	0.01

The statistical analysis identified housing type (OR=0.2, c.i._{.95%OR}=0.0-0.7, p=0.01) and rearing accommodation (OR=6.1, c.i._{.95%OR}=1.5-24.3, p=0.01) as significant variables from the initial model (Table 2). Cubicle refusal occurred less frequently in herds in sheds of Type 2, with a double row of face-to-face cubicles with passages at both ends, than in the other two types of sheds on day 2 after transfer. Furthermore, cubicle refusal was found to occur more frequently among heifers reared in slatted floor group pens than among those reared in other accommodation.

Concentrate feed dispenser

A relatively large proportion of the heifers (52%) visited the dispenser on the first day after transfer. The proportion increased gradually, reaching 85% on Day 7.

The mean time elapsing from transfer of a heifer until its first recorded visit to the concentrate dispenser was 2.4 days. Eight percent of the heifers did not visit the dispenser at all during the 7 days of observation.

The heifers did not release all of their allotted concentrate on the first days they visited the dispenser. The mean amount of concentrate re-

leased on Day 1 was 35% of the available ration. This figure increased rapidly, and on Day 7 the amount released comprised 81% of the allotted ration.

The three groups of heifer observations which had been created according to cubicle use the three first nights after transfer, were also studied concerning concentrate dispenser use. The heifers which were observed to use the cubicles on all of the initial three nights started visiting the concentrate dispenser earlier than the other animals (Fig. 4). The heifers which had not been observed to use the cubicles at all during the first three days after transfer were the slowest to start visiting the dispenser. The proportion of heifers visiting the concentrate dispenser increased steadily in all three groups during the seven-day observation period.

However, none of the variables SLATS (p=0.13), HESIZE (P=0.12), TYPE1 (p=0.40) or TYPE2 (p=0.38) were found to be significant for feed dispenser use when tested in the logistic regression analysis (N=188).

Discussion

Missing observations were more common towards the end than in the beginning of each

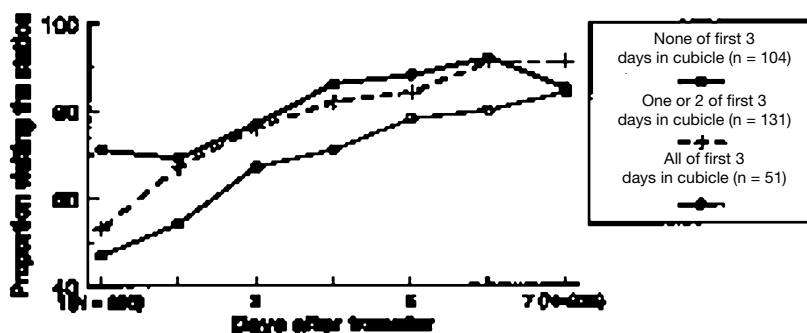


Figure 4. Visits to the feed dispenser in relation to cubicle use on the first 3 days after being transferred into the herd.

heifer's observation period, which may have been due to declining motivation of the observers. Another explanation for the decline is that the farmers after a few days may have recognised a pattern of behaviour and did not bother to record the same behaviour repeatedly. An eventual tendency within the missing observations may arguably be directed towards either a) no change in lying behaviour, represented by the conservatively substituted data in Fig. 2, or b) changing into cubicle use, represented by the progressively substituted data set. Assuming that the actual distribution of the missing observations was somewhere in between, Fig. 2 indicates that the present drop-out did not result in a biased data set.

The farmers themselves made the observations and recorded the data. However, none of them had any previous experience in recordings of this kind, so to ensure adequate standardization of the data, the behaviour categories were defined in a simple manner and, as far as possible, made self-evident. This method provided a large number of observations with limited resources, but resulted in a data set consisting of observations in herd subsets or clusters. Logistic regression with random effects makes it possible to take such clustering into account (*Sta-*

tistics and Epidemiology Research Corporation 1991), and it was therefore chosen for analysis of the data.

The occurrence of cubicle refusal was relatively high just after the heifers were transferred to the cubicle yard. It decreased throughout the observation period, but was still fairly high (23%) 15 days after transfer (Fig. 2). The result for Day 15 is comparable to that of *Kjæstad & Simensen* (1999), who studied cubicle use during the last week of pregnancy and found that 29% of the heifers were showing cubicle refusal during this time.

The association between cubicle refusal during the first days after transfer and subsequent cubicle refusal seemed strong. This is supported by the observations made around calving and 6 months later, showing that many individuals kept refusing the cubicles for a long period of time. The tendency for this behaviour to persist has earlier been found in an experimental setting. *O'Connell et al.* (1993b) placed 3 groups of heifers in pens equipped with standard cubicles, and among their results are an observation that some of the heifers were very consistent in refusing the cubicles throughout the experimental period. *Baehr et al.* (1984), after studying several herds, conclude that cubicle refusal

is generally associated with consistent cubicle refusal by a few individual cows, and not caused by occasional cubicle refusal by many cows in the herds. Such findings suggest that controlling the behaviour of a few problem animals may reduce cubicle refusal significantly. Culling may be seen as a tempting solution in some cases, but this is to be avoided because of the high cost associated with premature culling. Cubicle refusal on Day 2 after transfer was found to be associated with rearing in slatted pens. The result is in accordance with those of *Kjæstad & Myren (2001)*, *Kjæstad & Simensen (2001)* as well as *O'Connell et al. (1993a, 1993b)*, whose findings indicate that rearing on fully slatted floors creates a habit or preference for this type of lying surface even after cubicles have become available. The study by *Kjæstad & Simensen (2001)* reports a remarkably similar OR for rearing in slatted floor pens as a risk factor for cubicle refusal (OR=5.1) to that found in the present one (OR=6.1), indicating that it is a common and important factor.

Our results indicating that cubicle refusal is less frequent in houses with a double row of face-to-face cubicles are supported by the results of *Maton et al. (1981)*. They recorded the occupation frequency of cubicles in a shed which had both one row of cubicles facing a wall as well as a double row of face-to-face cubicles. The cubicles in the double row were more frequently used than the others. The cited results were based on findings in only one herd, and the manifestation of this tendency across many herds in the present study validates the earlier finding. The cited authors also found that cubicles situated at the very end of a row are less occupied than those in the middle. A similar finding is reported by *Potter & Broom (1986)*, who observe that individuals of low social status especially prefer the centrally placed cubicles. The Type 2 shed in the present study had a higher proportion of such centrally placed cu-

bicles than the Type 1 and Type 3 design sheds, which may therefore be one factor contributing to the lower level of cubicle refusal in these sheds. Another possible factor is the presence of passages at both ends of the rows of cubicles in the Type 2 sheds, which may function as a way for heifers to escape when approached by herd mates of higher social status. The absence of such passages creates possible dead ends, and fear of getting trapped could perhaps discourage a heifer from searching all of the shed for available cubicles. Support for the significance of this factor comes from an unpublished study (*H.J. Myren*, personal communication), where it is found that closing off one of the 2 passages in a Type 2 shed, thereby increasing the chances of cows opposing one another in the remaining passage, causes a significant rise in the number of aggressive interactions. A final factor worth considering is that a cubicle facing another is in itself more attractive than one which is facing a wall. As there is normally no solid partition between the 2 facing rows, the Type 2 design provides the cows with some welcome extra head space when lying down and getting up compared to the situation where the animal faces a solid wall.

Although the proportion of heifers using the concentrate feed dispenser was relatively low to begin with, the proportion increased considerably during the observation period. This is in accordance with the results of *Smits and Ipema (1980)*, reporting that 90% of the heifers are using the dispenser within one week. The heifers in the present study generally did not release all of their allotted daily rations. However, it is well known that heifers as well as cows normally have a high appetite for concentrate feed, and the finding was probably due to the inexperienced heifers' inability to anticipate when the next portion would be available, rather than a satiated appetite.

None of the factors found to be significant for

cubicle use were identified as significant in the analysis of feed dispenser use. Nevertheless, the graph of dispenser use in the 3 groups of heifers made on the basis of cubicle use (Fig. 4) suggests that the behavioural patterns in these 2 contexts may still be induced by common factors.

The main conclusion we draw from the present study is that it is important to provide an adequate period of adaptation to the novel environment, not only in respect to cubicle use, but also concerning an adequate, gradually increasing concentrate intake. Furthermore, we conclude that cubicle refusal in heifers occurs frequently during the first days after transfer into the cow herd, that it seems to persist in some individuals, and that rearing accommodation and cubicle layout influence the occurrence of the problem. Finally, the study shows that failure to use the concentrate feed dispenser during this time is also relatively common, and it is a serious concern that some individuals do not use the dispenser at all during the week after transfer into the herd.

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Sammendrag

Svikt i kvigenes bruk av liggebåser og kraftförautomat etter innslipp i liggebåsavdelingen.

Målet for studien var å beskrive og analysere kvigenes bruk av liggebåser og kraftförautomat i løpet av de første dagene umiddelbart etter innslipp i løsdriftsavdelingen sammen med kyrne. Det ble inkludert 33 besetninger i fylkene Østfold og Akershus. Bonden foretok observasjoner og registreringer av liggebåsbruk en gang hver kveld i 15 dager etter innslipp av en eller flere kviger. Tilsvarende registreringer ble gjort på besøk i kraftförautomaten i 7 dager. Liggebåsbruken ble analysert ved logistisk regresjon der oppstallingstype for kviger, besetningsstørrelse og type planløsning var uavhengige variabler. Besetning ble brukt som tilfeldig-effekt-

variabel. En liknende analyse av besøk i kraftförastasjonen ble også gjort. Gangligging (GL) ble observert hos en tredel av kvigene på dag 2 etter innslipp, men ved dag 15 var andelen sunket til en femdel. Gangligging var generelt lavere gjennom hele perioden hos den andelen av kvigene som hadde ligget i bås de tre første nettene. Denne tendensen kunne merkes så sent som seks måneder etter innslipp. Analysen viste at det var sammenheng mellom GL og kvigeoppdrettsmiljø (OR=6.1, $c.i.^{95\%OR}=1.5-24.3$, $p=0.01$) samt mellom GL og planløsningstype (OR = 0.2, $c.i.^{95\%OR}= 0.0-0.7$, $p = 0.01$). Ingen av de undersøkte faktorene var signifikante i analysen av kraftförautomatbruk. Det var også relativt vanlig at kvigene ikke brukte kraftförastasjonen, og åtte prosent av kvigene brukte den ikke i det hele tatt i løpet av de sju dagene observasjonene fant sted.

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