

Investigation of Reasons for Culling in Chungcheong Dairy Herds

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Abstract : This study was conducted to investigate reasons for culling of Chungcheong dairy herds and to investigate the relationships between cow parity, interval from calving to culling, or season and culling reasons. Lactation data from 826 cows on 9 dairy farms from 2013 to 2015, including reasons for culling, dates of birth, last calving, and culling, were analyzed. The overall culling rate was 29.8% (246/826), with mammary problems (23.2%) being the most prevalent reason for culling, followed by infertility (14.2%) and downer cow syndrome (11.0%). The culling rate varied among farms (18.8-43.1%, $p < 0.05$), but was greater in parity $4 \leq$ (40.7%) than parities 1, 2, or 3 (17.9-23.6%), whereas the rate was less frequent during mid lactation (21.1%) than in early (36.2%) or late (42.7%) lactation. Moreover, the culling rate was greater during summer (35.8%) than other seasons (20.3-23.2%). Mammary problems, downer cow syndrome, and metabolic disorders were the more common reasons for culling during early lactation, whereas infertility was predominant during late lactation. Our data show that the culling rate in Chungcheong dairy herds was associated with cow parity, interval from calving to culling, and season, with the main reasons for the removal of cows from dairy herds being mammary problems, infertility, and downer cow syndrome.

Key words : culling, reasons, disease, infertility, dairy cows.

Introduction

It is essential to reduce costs to overcome lower productivity in the dairy cattle industry, especially under the milk quota systems and an open economy. Rearing of heifer replacements accounts for 15-20% of the total milk production cost (13). Thus, reduction of culling (including death) may decrease economic losses in dairy farms *via* decreases in heifer replacements. In general, culling is classified as voluntary or involuntary. Involuntary culling implies that cows were culled due to disease, injury, infertility or death, whereas low yield or surplus cows are reasons for voluntary culling because the animals are healthy and farmers have complete freedom of choice over which cows are removed from the herd (7). Similar classifications have been utilized in other studies (1,8). It has also been reported that udder or mastitis problems were the primary reason (27%) for culling, followed by reproductive problems (26%), lameness or injury (16%), poor production (19%), disease (6%), aggressiveness (1%), and unspecified reasons (4%, 16). Moreover, a strong association between reproductive performance and cow survival has been reported (18), whereas the greatest risk of culling has been reported in the early lactation period and after 420 days post-calving (8).

Economic pressure has encouraged dairy producers to increase efficiency by implementing management changes in which many changes (shifting from tie-stalls to free-stalls,

feeding a total mixed ration [TMR], and limiting pasture access) were associated with greater mortality rates (14). In recent years, dairy cows have shown a trend for lower survival rates (12,15), and higher involuntary culling rates are a concern on dairy farms (22). Since involuntary culling has detrimental effects on farm profits, farmers should strive for less involuntary culling to allow more voluntary culling (22).

Culling is affected by management style, reproductive policy, type of facilities, level of production, herd size, and other factors (11,12,14). Thus, identifying reasons for culling can be helpful to determining management problems in herds, but also to establishing a strategy for decreasing culling. However, information regarding the main reasons for culling in Korean dairy herds is limited. Therefore, this study was conducted to investigate reasons for culling in Chungcheong dairy herds, and as well as to investigate the relationships between cow parity, interval from calving to culling, and season and reason for culling.

Materials and Methods

Animals and herd management

This study was conducted in Chungcheong Province from 2013 to 2015. Nine dairy farms (A-I) were selected for the study. In the study herds, all cows (826) were fed a TMR and milked twice daily. The mean milk yield was approximately 10,000 kg per year per cow. In addition, cows received regular reproductive health checks every 2 to 4 weeks, including examination of ovarian structures and the uterus *via* transrectal palpation and ultrasonography.

The voluntary waiting period from calving to the first arti-

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ficial insemination (AI) was 50 days. In addition to estrous detection, a herd reproductive management program was employed for cows failing to receive AI within the 60-day postpartum interval. This included estrus synchronization using PGF_{2α}. In addition, Ovsynch, which combined GnRH on day 0-PGF_{2α} on day 7-GnRH on day 9 was also included. Cows that exhibited estrus naturally or after estrus synchronization using PGF_{2α} were inseminated according to the am-pm rule, whereas those treated with Ovsynch received timed AI. Pregnancy was diagnosed rectally 40-50 days after AI using both ultrasonography and manual palpation.

Culling reasons

The incidence of culling (including death) and any health problems during each lactation were recorded for each cow. Culling reasons were categorized by the faculty of Chungbuk National University (corresponding author) using classifications similar to those used in previous studies (1,2,16,17). A total of 34 codes were used to describe the primary cause of culling. These codes were divided into 10 groups: mammary problems (mastitis, high somatic cell count, agalactia, and teat trauma), infertility (not pregnant), downer cow syndrome, foot-locomotor problem (lameness, foot-rot, and pododermatitis circumscripta), reproductive disease (dystocia, retained placenta, abortion, metritis, endometritis, and mummification), metabolic disorders (ketosis, milk fever, and displaced abomasum), digestive disease (indigestion, gastroenteritis, enteritis, ulcer, and tympany), physical problems (dislocation, bleeding, rupture of tendon, and tumor), voluntary culling (low production, high age, aggressiveness), and others (septicemia, shock, leukemia, or unspecified disease). In the present study, culling was defined as involuntary culling, which included culling due to disease, infertility, physical problems or death, and did not include voluntary reasons such as low production, high age, and aggressiveness. Culling rate was calculated by dividing the sum of involuntary and voluntary culled cow counts by the total number of cows.

Statistical analysis

For analyses, cow parities were categorized as 1, 2, 3, or ≥ 4, and calving to culling interval was categorized as ≤ 90 (early lactation), 91-180 (mid lactation), ≥ 181 days after calving (late lactation), whereas culling season was grouped as spring (March to May), summer (June to August), fall (September to November), and winter (December to February).

The culling rate among farms was compared using the Chi-square test in SAS (version 9.4, SAS Institute Inc., Cary, NC, USA). Differences with $p < 0.05$ were considered significant.

Results and Discussion

The overall culling rate was 29.8% (246/826), which was similar to previously reported ranges of 31.7% to 33.3% (6,11,17). The involuntary culling rate was 89.4% in the present study, which was greater than that observed in a previous study in which involuntary culling was 68% (3). A higher involuntary culling rate may lead farmers to have less power to decide voluntary culling, and may be affected by management style, reproductive policy, type of facilities,

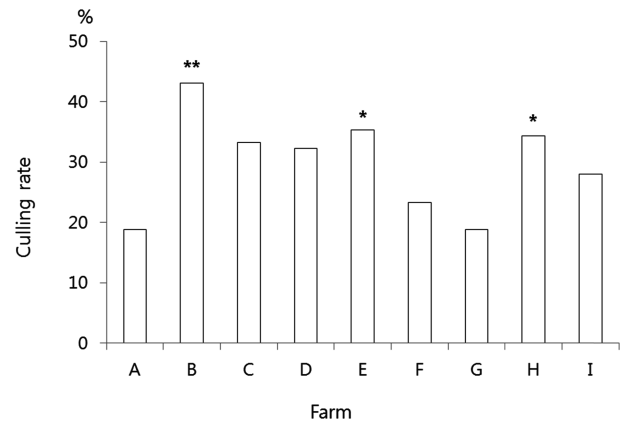


Fig 1. Culling rate in 826 lactations on nine Chungcheong dairy farms (A-I).

* $p < 0.05$; ** $p < 0.01$ significant difference relative to farm A.

Table 1. Reasons for culling in Chungcheong dairy herds

Categories of disorders	No. Cows	Percentage (%)
Mammary problems	57	23.2
Infertility	35	14.2
Downer cow syndrome	27	11.0
Voluntary culling	26	10.6
Foot-locomotor problems	22	8.9
Reproductive disease	18	7.3
Metabolic disorders	17	6.9
Digestive disease	16	6.5
Physical problems	13	5.3
Others	15	6.1
Total	246	100.0

level of production, herd size, cattle breed, and other factors (11,12,14). Thus, strategies to reduce involuntary culling in dairy herds might be needed to prevent economic losses. They may be comprised of farm management improvement including herd health and reproduction controls and farm policies regarding level of production, herd size, and type of facilities. Culling rate varied from 18.8% to 43.1% among the nine farms in this study (Fig 1). This high variation may have been due to different farm management practices, environments, and facilities.

In the present study, the main reasons for culling were mammary problems (23.2%), infertility (14.2%), and downer cow syndrome (11.0%, Table 1). Our findings were similar to those of a previous study (1) in which poor udder health (22.5%), low fertility (24.8%), and low production (6.2%) were the main reasons for culling. In addition, the National Animal Health Monitoring System (16) reported that udders or mastitis problems were the leading reasons (27%) for culling, followed by reproductive problems (26%), lameness or injury (16%), poor production (19%), disease (6%), aggressiveness (1%), and unspecified reasons (4%). However, a previous study showed that injury (26.9%), reproduction (18.9%), low production (12.8%), and mastitis (12.1%) were the main reasons for culling (11). Dechow and Goodling (6) also

Table 2. Relationships between cow parity and reason for culling

Categories of disorders	Cow parity (Cow No., %)			
	1	2	3	4 ≤
Mammary problems	9 (20.5)	10 (22.7)	14 (24.1)	24 (24.0)
Infertility	9 (20.5)	9 (20.5)	7 (12.1)	10 (10.0)
Downer cow syndrome	4 (9.1)	2 (4.5)	7 (12.1)	14 (14.0)
Voluntary culling	4 (9.1)	5 (11.4)	5 (8.6)	12 (12.0)
Foot-locomotor problems	3 (6.8)	5 (11.4)	4 (6.9)	10 (10.0)
Reproductive disease	5 (11.4)	4 (9.1)	1 (1.7)	8 (8.0)
Metabolic disorders	0 (0.0)	0 (0.0)	9 (15.5)	8 (8.0)
Digestive disease	0 (0.0)	3 (6.8)	7 (12.1)	6 (6.0)
Physical problems	4 (9.1)	3 (6.8)	0 (0.0)	6 (6.0)
Others	6 (13.6)	3 (6.8)	4 (6.9)	2 (2.0)
Total	44 (17.9)	44 (17.9)	58 (23.6)	100 (40.7)

reported that culling because of injury and reproduction problems were predominant. Furthermore, another study reported that infertility (32.6%) was the most common reason for culling, followed by mastitis (6.5%) for involuntary causes, whereas aging (8.1%) and low production (8.7%) were the main reasons for voluntary culling (2). Similarly, Pinedo *et al.* (17) reported that the primary reason for culling was reproduction (17.7%), injury (14.3%), low production (12.1%), and mastitis (12.1%). Interestingly, our observation that downer cow syndrome was one of the main reasons for culling was not reported in any other publications. The reason for this discrepancy is not clear; however, it might be related to different nutritional and rearing management systems and environments (weather, geography, and region) among studies.

Table 2 shows the relationships between cow parity and culling reasons. Ratios for the culling per parities 1, 2, 3, and ≥ 4 were 17.9%, 17.9%, 23.6%, and 40.7%, respectively, indicating that the ratios for culling increased with increasing cow parity. Proportions of culling for parities 1, 2-3, and ≥ 4 were 24.8%, 36.6%, and 38.6%, respectively (19), which was similar to results of the present study. Our findings were also consistent with those of a previous study in which greater parity was related to the greatest risk of culling (15,21). Similarly, another publication reported that 59% of cows were culled before the fourth lactation (3). The main reasons for culling were reproductive disease (11.4%), downer cow syndrome (9.1%), voluntary culling (9.1%), and physical problems (9.1%) in parity 1, voluntary culling (11.4%), foot-locomotor problems (10.0%), and reproductive disease (9.1%) in parity 2, downer cow syndrome (12.1%), metabolic disorders (15.5%), and digestive disease (12.1%) in parity 3, and downer cow syndrome (14.0%), voluntary culling (12.0%), and foot-locomotor problems (10.0%) in parity ≥ 4, respectively, in the present study, whereas mammary problems and infertility were the main reasons for all parities. Similarly, Pinedo *et al.* (17) found that reproduction and injury were the main reasons for culling in all parities, but that mastitis was less common in parity 1 than parities of 2 to

Table 3. Relationships between interval from calving to culling and reason for culling

Categories of disorders	Interval (days) from calving to culling (Cow No., %)		
	90 ≥	91-180	181 ≤
Mammary problems	22 (24.7)	16 (30.8)	19 (18.1)
Infertility	1 (1.1)	1 (1.9)	33 (31.4)
Downer cow syndrome	16 (18.0)	3 (5.8)	8 (7.6)
Voluntary culling	5 (5.6)	9 (17.3)	12 (11.4)
Foot-locomotor problems	5 (5.6)	8 (15.4)	9 (8.6)
Reproductive disease	6 (6.7)	0 (0.0)	12 (11.4)
Metabolic disorders	16 (18.0)	1 (1.9)	0 (0.0)
Digestive disease	6 (6.7)	7 (13.5)	3 (2.9)
Physical problems	6 (6.7)	3 (5.8)	4 (3.8)
Others	6 (6.7)	4 (7.7)	5 (4.8)
Total	89 (36.2)	52 (21.1)	105 (42.7)

≥ 4, and culling due to problems with feet and legs became more common as the parity increased. Consistent with our findings, udder health and low fertility were common reasons for culling for all parities of 1, 2, and 3 in Swedish dairy farms (1). However, culling because of foot lesions in cows with ≥ 3 lactations (49.2%) was higher than that for cows of lactations 1 (26.2%) and 2 (24.7%) (5).

The relationships between interval from calving to culling and reason for culling are shown in Table 3. The main reasons for culling were downer cow syndrome (18.0%) and metabolic disorders (18.0%) within 90 days after calving, voluntary culling (17.3%), foot-locomotor problems (15.4%), and digestive disease (13.5%) during 91-180 days after calving, and infertility (18.1%), voluntary culling (11.4%), and reproductive disease (11.4%) at more than 180 days after calving, whereas mammary problems were the main reason for all times after calving. A previous study showed that proportions of culling for calving-to-culling interval (days) of < 101, 101-250, 251-350, 351-450, and > 450 days were 12.2, 23.7, 30.4, 23.3, and 10.4%, respectively (19). It has also been shown that early lactation was a critical period for culling with injury and disease, and that the risk increased with days after calving for low production and reproduction (17), which were similar to our data except for mammary problems. Similarly, a Japanese study (10) demonstrated that reasons for culling within 39 days after calving included perinatal (31.3%), locomotive (19.0%), udder (17.6%), and digestive problems (13.4%). Culling risks are affected by physiological processes, such as calving, lactation, energy balance, reproduction, and aging (17). Furthermore, a critical time for survival is the transition period, during which cows experience a series of rapidly changing physiological statuses and most metabolic diseases occur (9). Cows culled for emergency reasons were more frequently younger cows in early lactation (19), which was consistent with our finding that downer cow syndrome and metabolic disorders were common emergency situations leading to culling. Cows diagnosed with lameness during the first 60 days after calving appeared to be at greatest risk of being culled between 121

Table 4. Relationships between season and reason for culling

Categories of disorders	Season (Cow No., %)			
	Spring	Summer	Autumn	Winter
Mammary problems	14 (28.0)	21 (23.9)	10 (19.6)	12 (21.1)
Infertility	12 (24.0)	9 (10.2)	5 (9.8)	9 (15.8)
Downer cow syndrome	3 (6.0)	9 (10.2)	10 (19.6)	5 (8.8)
Voluntary culling	4 (8.0)	10 (11.4)	4 (7.8)	8 (14.0)
Foot-locomotor problems	5 (10.0)	8 (9.1)	6 (11.8)	3 (5.3)
Reproductive disease	2 (4.0)	5 (5.7)	4 (7.8)	7 (12.3)
Metabolic disorders	2 (4.0)	10 (11.4)	1 (2.0)	4 (7.0)
Digestive disease	5 (10.0)	3 (3.4)	5 (9.8)	3 (5.3)
Physical problems	2 (4.0)	4 (4.5)	4 (7.8)	3 (5.3)
Others	1 (2.0)	9 (10.2)	2 (3.9)	3 (5.3)
Total	50 (20.3)	88 (35.8)	51 (20.7)	57 (23.2)

and 240 days after calving (4), which is similar to our findings that culling because of foot-locomotor problems was most common from 91 to 180 days after calving. Our finding that infertility was predominant during late lactation makes a sense. Similarly, cows that required more services per conception, a longer interval between first service to conception, an interval between calving to first service greater than 90 days, and had increased days open were at greater risk of being culled (20).

The relationships between season and reason for culling are shown in Table 4. The ratios of culling increased during summer (35.8%) relative to other seasons (20.3%-23.2%). The main reasons for culling were foot-locomotor problems (10.0%) and digestive disease (10.0%) during the spring, metabolic disorders (11.4%), voluntary culling (11.4%), and downer cow syndrome (10.2%) during summer, downer cow syndrome (19.6%), foot-locomotor problems (11.8%), and digestive disease (9.8%) during autumn, and voluntary culling (14.0%) and reproductive disease (12.3%) during winter, whereas mammary problems and infertility were the main reasons for culling across all seasons. Similarly, Pinedo *et al.* (17) found that mastitis, reproduction, low production, and injury were the main reasons for culling during all seasons. Taken together, our data show that the frequency of the incidence of culling was associated with cow parity, interval from calving to culling, and season, in which the main reasons for the removal of cows from dairy herds were mammary problems, infertility, and downer cow syndrome in Chungcheong dairy herds. These findings also suggest that dairy farmers and veterinary practitioners should establish a strategy for monitoring the hygiene control for mammary, reproductive and metabolic problems.

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