

## ORIGINAL ARTICLE

# Characterisation and pattern of culling in Holstein-Friesian dairy herds in Khorasan Razavi Province, Northeast of Iran

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**Abstract**

To describe proportion and pattern of culling in commercial dairy herds of Khorasan Razavi Province, this survey was carried out from 21<sup>st</sup> March 2008 to 20<sup>th</sup> March 2009 in 15 industrialized dairy herds. For each culled cow data related to parity at culling, last calving to culling interval and primary reason for culling were recorded. Annual herd exit rate was 20.9%. Out of a total of 652 culled cows, the proportions of culled dairy cows were due mainly to involuntary culling with very small proportion of voluntary culling (4%). The involuntary culling were mainly from infertility or reproductive disorders (23.6%), udder disorders (17.5%) and digestive tract disorders (15.9%). Average  $\pm$  SD of parity at culling was  $3.15 \pm 1.96$ . Culled cows from digestive tract disorders, injuries and infectious diseases were significantly younger than those of other culling reasons ( $P < 0.05$ ). Mean  $\pm$  SD of last calving to culling interval was  $194 \pm 159$  days. Culled cows from digestive tract disorders, injuries and udder disorders were removed earlier in lactation period than cows culled from reproductive disorders, infectious diseases and lameness ( $P < 0.05$ ). Low proportion of voluntary and high percentage of involuntary culling specially from health problems should be considered as an important economic loss and precaution measures are necessary to reduce this loss.

**Introduction**

One of the critical goals in dairy farm husbandry is economic profit via mainly increase in milk and calf production. Culling management is one of the most important determinants of this goal. Culling in dairy farming systems can be defined as departure of cows from the herd due to sale, slaughter and salvage or death.<sup>1</sup> In general, culling system in dairy farms is classified into two major categories, voluntary and involuntary. Culling of high yielding dairy cows due to death, acute and severe disease or reproductive problems is defined as involuntary culling. In contrast, removal of cows from dairy herd due to termination of productive life from other than health disorders or due to excessive number of cows in the herd is defined as voluntary culling. In fact, culling of sick, non-pregnant and low producing dairy cows and replacing them with high quality heifers, increases profits and/or reduces costs. Optimum dairy herd profitability is mainly achieved by minimizing and maximizing proportion of involuntary and voluntary culling, respectively.<sup>2-4</sup>

The average annual culling proportion in dairy herds

varies from roughly 23 to 35%.<sup>5-9</sup> Milk production level, fertility status, age, health status, stage of lactation and cost of the replaced dairy cows are the most considerable factors in culling decisions.<sup>4,10,11</sup> Numerous studies have shown that infertility followed by udder disorders, especially mastitis, low milk production and lameness are the main reasons for culling.<sup>9,12,13</sup>

In Iran there are 15541 commercial dairy herds with 1719798 high yielding dairy cows (www.amar.org.ir). A relatively small number of studies have examined culling rate and characterization of culled dairy cows under Iranian dairy farming conditions. This study was therefore designed to report descriptive aspects and the reasons of culling in commercial dairy herds in one of the biggest dairy producing region in Iran, Khorasan Razavi Province.

**Material and methods**

The study was performed in Khorasan Razavi Province, which is one of the most important centre of dairy product

manufacturing located in Northeast of Iran, close to the borders of Afghanistan and Turkmenistan. This area included more than one tenth (174000) of total commercial dairy cattle population. Data were collected from 15 commercial dairy herds. These herds were used because of the completeness of their records and farmer compliance. All cows in the study herds were Holstein-Friesian. Four of the fifteen participant herds had a full time on-staff veterinarian and the rest of them had been under a program of regular visit for pregnancy diagnoses, reproductive management and treatment of sick animals under direction of veterinarians. They contained 90 to 610 milking cows, which were housed in open-shed barns and fed on total mixed rations (corn silage, alfalfa, hay and concentrates). In the studied herds the 305-day milk production ranged from 7472 to 9150 kg per milking cow.

The study population was composed of all lactating cows presented in dairy herds between 21 March 2008 and 20 March 2009. Calves and heifers were not included in the study.

Number of cows at the beginning of study, entry and exit of cows into the study herds during the study period was recorded. For each cow that culled during the study period, identification of cow, herd of origin, parity at culling, last calving date, culling date and primary reason for culling were recorded.

Primary reasons for culling were broadly categorized into 10 groups. Definition of each culling reason used in this study is shown in Table 1.

**Statistical analyses.** From epidemiological point of view, culling rate is calculated as number of culled cows over a specified time period divided by average number of cows at risk for being culled over the same period.<sup>14</sup> Mean of parity at culling, average calving to culling time and proportions of culls for each group of culling reasons were calculated. Chi-Square test was used to assess the relationship between parity at culling and primary reasons for culling. A one-way ANOVA test was used to compare average parity at culling and average calving to culling interval with respect to culling reasons categories. Comparison of calving to culling interval for different levels of parity at culling were also analysed using the above mentioned test. All statistical analysis performed using SPSS statistical software version 16 (SPSS Inc., Chicago, USA) and P-value less than 0.05 was considered as significant.

## Results

Overall, 652 (20.9%) cows were culled during the study period. Minimum and maximum of culling rate in the study herds were 12 and 28%, respectively. The proportions of culled dairy cows were due mainly to involuntary culling (96%) with very small proportion of voluntary culling (4%). The most-frequent primary involuntary culling reasons were: infertility or reproductive disorders (23.6%), udder disorders (17.5%) and digestive tract disorders (15.9%).

Culling reasons for 2.5% of culled cows were unknown.

In comparison with other reasons for culling, dairy cattle, which were culled for digestive tract, disorders were more frequent at parity 1 and 2 compared with parity  $\geq 5$  ( $P < 0.05$ ). In contrast, cows, which were culled for voluntary reasons, were more frequent at parity  $\geq 5$  compared with parity 1, 2, 3 and 4 ( $P < 0.05$ ) (Table 2).

Average  $\pm$  SD of parity at culling and calving to culling interval were  $3.15 \pm 1.96$  and  $194 \pm 159$  for 652 culled cows, respectively.

Mean parity at culling and calving to culling interval for each category of culling reason are presented in Table 3. Average parity at culling of cows culled for digestive tract disorders, injuries and infectious diseases was significantly less than those culled for infertility or reproductive disorders, udder disorders, calving difficulties, lameness, miscellaneous and voluntary reasons ( $P < 0.05$ ). Cows culled for digestive tract disorders, injuries, udder disorders, calving difficulties and voluntary reasons were removed earlier in lactation than those culled for reproductive disorders, infectious diseases and lameness ( $P < 0.05$ ). Last calving to culling interval for different levels of parity is presented in Table 4. Average calving to culling interval for cows culled after second calving was longer than those removed after forth and  $\geq 5$  calving ( $P < 0.05$ ). Also, this interval for cows culled at third parity was longer than those culled at forth parity ( $P = 0.032$ ).

## Discussion

The present descriptive study provides an insight into the proportion and pattern of culling in high yielding dairy cows in commercial dairy farms in Northeast of Iran. The description clearly showed that the proportions of culled dairy cows were due mainly to involuntary culling ranging from reproductive, udder and gastrointestinal disorders to injuries with small proportion of voluntary culling. The underlying reasons for this respectively high and very low proportion of involuntary and voluntary culling are many; among them are economic reasons and management procedure. In our study annual culling rate was about 21%. In other study conducted in Iran, culling rate was reported about 13%, which was much lower than what we observed.<sup>15</sup> The annual culling rate for commercial dairy herds has been estimated at 30.2% in south eastern part of Poland,<sup>12</sup> 23.6 and 35.1% in USA,<sup>16,17</sup> 31.6% in Finland,<sup>7</sup> 32.3% in western France,<sup>13</sup> and 26% in New South Wales, Australia,<sup>9</sup> that was higher than that of our results. Voluntary culling proportion in the present study was low (4%); this was similar to result of other survey carried out in Iran,<sup>15,18</sup> but it was lower than the proportion reported by other investigators in other parts of the world.<sup>9, 12, 13</sup> High cost of replacement and low carcass value seem to be the most important reasons for lower percentage of total and especially voluntary culling. Cost of a heifer to replace with a culled cow in Iran is about \$ 3,000.<sup>18</sup> Infertility or reproductive disorders followed by udder disorders were

the most important reasons of culling in our study; this is in agreement with many previous studies.<sup>9,12,13,19</sup> However, the proportion of culling due to digestive tract disorders and infectious diseases was higher than the proportion reported in other surveys.<sup>5,12</sup> Also, in the studied herds culling of dairy cows due to digestive tract disorders were more frequent at lower parities. These results indicated that other issues like feeding management, biosecurity and health status in the dairy herd complex should be deeply taken into consideration to reduce these kinds of culling.

Average parity at culling was 3.15. The average parity at time of removal, reported by other researchers, varied from 2.94 to 4.<sup>9,20,21</sup> In our study culled cows due to lameness, udder disorders, infertility and voluntary reasons were at higher parity than culled cows for some other reasons like digestive tract disorders, injuries and infectious diseases. Seeger *et al.* (1998) reported similar results about lameness, udder disorders and voluntary culling reasons, pointing that culled cows from these reasons were more frequent at 4<sup>th</sup> -6<sup>th</sup> parities; but culled cows from infertility or reproductive disorder were younger, and most of them

culled before 3<sup>rd</sup> parity.<sup>13</sup> Reproductive disorder occurs more frequent in high milk producing cows.<sup>2</sup> Cows at 2<sup>nd</sup> - 4<sup>th</sup> parities produce more milk than other parities; so it is likely that most culling due to reproductive disorder might occur at 2<sup>nd</sup> to 4<sup>th</sup> parities.

Average length of time that a cow remained in the herd after last calving (194 days) was less than 212 and 284 days reported by others.<sup>9,13</sup>

About average calving to culling interval with respect to culling reasons, cows culled from reproductive disorders were removed later in lactation than cows culled from some other reasons. This was similar to those reported by Seeger *et al* (1998).<sup>13</sup> Milk yield had a significant effect on culling decisions; that is, the high milk producing cows were at the lowest risk of being culled.<sup>16,22</sup> Furthermore, infertility is more frequent in the high milk producing cows.<sup>2</sup> Apart from being infertile, these high milk producing cows are normally kept in the herds for longer time. Average calving to culling interval for cows culled after 2<sup>nd</sup> and 3<sup>rd</sup> calving was longer than those culled after fourth and more than fourth calving; this might be due to higher milk

**Table 1.** Definition of culling reasons categories

Category	Definition
1 <b>Udder disorders</b>	Acute mastitis, High milk somatic cell count, Udder health problem (Ruptured suspensory ligaments, Teat injuries), Slow milker
2 <b>Infertility or reproductive disorders</b>	Failure to conceive or reproductive disorder includes Metritis, Endometritis, Cystic ovarian disease and other identifiable lesions
3 <b>Digestive tract disorders</b>	Displaced abomasums, Bloat and other gastrointestinal diseases
4 <b>Lameness</b>	Foot/leg defect
5 <b>Infectious diseases</b>	Johne's disease, MCF, TB, Brucellosis, Respiratory disorders
6 <b>Injuries</b>	Fractured bones or luxation
7 <b>Calving difficulties</b>	Dystocia and stillbirth (Any assistance provided for delivery of the calf at birth)
8 <b>Other disorders</b>	Metabolic diseases, Downer cow syndrome and Miscellaneous diseases
9 <b>Unknown reasons</b>	Without any recorded reason
10 <b>Voluntary culling</b>	Low milk production in the absence of a known disease problem, Old age, Surplus to herd requirements and all other voluntary culling

**Table 2.** Frequency of declared primary culling reasons (voluntary and involuntary) versus parity (652 culled Holstein cows).

Culling reasons	Parity					Total Number (%)
	1	2	3	4	≥ 5	
Digestive tract disorders	26 <sup>a</sup>	36 <sup>a</sup>	20 <sup>ab</sup>	12 <sup>ab</sup>	10 <sup>b</sup>	104 (15.9%)
Calving difficulties	4 <sup>a</sup>	6 <sup>a</sup>	6 <sup>a</sup>	6 <sup>a</sup>	8 <sup>a</sup>	30 (4.6%)
Infectious diseases	14 <sup>a</sup>	16 <sup>a</sup>	6 <sup>a</sup>	6 <sup>a</sup>	6 <sup>a</sup>	48 (7.4%)
Injuries	6 <sup>a</sup>	4 <sup>a</sup>	2 <sup>a</sup>	2 <sup>a</sup>	0 <sup>a</sup>	14 (2.1%)
Lameness	8 <sup>a</sup>	8 <sup>a</sup>	10 <sup>a</sup>	2 <sup>a</sup>	10 <sup>a</sup>	38 (5.8%)
Infertility or reproductive disorders	26 <sup>a</sup>	40 <sup>a</sup>	36 <sup>a</sup>	24 <sup>a</sup>	28 <sup>a</sup>	154 (23.6%)
Udder disorders	24 <sup>a</sup>	24 <sup>a</sup>	30 <sup>a</sup>	18 <sup>a</sup>	18 <sup>a</sup>	114(17.5%)
Other disorders	14 <sup>a</sup>	20 <sup>a</sup>	30 <sup>ab</sup>	16 <sup>ab</sup>	28 <sup>b</sup>	108 (16.6%)
Unknown reasons	6 <sup>a</sup>	6 <sup>a</sup>	2 <sup>a</sup>	2 <sup>a</sup>	0 <sup>a</sup>	16 (2.5%)
Voluntary culling	4 <sup>a</sup>	0 <sup>a</sup>	2 <sup>a</sup>	0 <sup>a</sup>	20 <sup>b</sup>	26 (4%)
<b>Total</b>	132	160	144	88	128	652 (100%)

Values within a row followed by different superscript letters are significantly different ( $P < 0.05$ ).

**Table 3.** Average parity at culling and calving to culling interval for each reason of culling

Reason	No.	Parity at culling	Calving to culling interval
		Mean $\pm$ SD	Mean $\pm$ SD
Digestive tract disorders	104	2.50 $\pm$ 1.34 <sup>a</sup>	181 $\pm$ 155 <sup>adf</sup>
Calving difficulties	30	3.66 $\pm$ 2.02 <sup>bd</sup>	5.20 $\pm$ 7.60 <sup>h</sup>
Infectious diseases	48	2.50 $\pm$ 1.45 <sup>ac</sup>	243 $\pm$ 151 <sup>bc</sup>
Injuries	14	2.00 $\pm$ 1.10 <sup>a</sup>	120 $\pm$ 103 <sup>ae</sup>
Lameness	38	3.52 $\pm$ 2.59 <sup>bd</sup>	216 $\pm$ 157 <sup>bd</sup>
Infertility or reproductive disorders	154	3.11 $\pm$ 1.74 <sup>bd</sup>	248 $\pm$ 123 <sup>bg</sup>
Udder disorders	114	3.01 $\pm$ 1.72 <sup>bc</sup>	158 $\pm$ 162 <sup>a</sup>
Other disorders	108	3.51 $\pm$ 1.88 <sup>d</sup>	217 $\pm$ 182 <sup>bf</sup>
Unknown reasons	16	2.00 $\pm$ 1.03 <sup>a</sup>	205 $\pm$ 154 <sup>acdfg</sup>
Voluntary culling	26	6.46 $\pm$ 3.08 <sup>e</sup>	144 $\pm$ 130 <sup>ad</sup>
<b>Total</b>	652	3.15 $\pm$ 1.96	194 $\pm$ 159

Values within a column followed by different superscript letters are significantly different ( $P < 0.05$ ).

**Table 4.** Mean, Standard deviation, Maximum and Minimum of last calving to culling interval by parity (652 culled Holstein cows).

Parity	No	Mean $\pm$ SD (days)	Minimum	Maximum
1	132	191 $\pm$ 175 <sup>ab</sup>	1	521
2	160	216 $\pm$ 163 <sup>a</sup>	1	542
3	144	206 $\pm$ 148 <sup>ac</sup>	1	505
4	88	158 $\pm$ 144 <sup>b</sup>	1	497
$\geq 5$	128	178 $\pm$ 153 <sup>bc</sup>	1	564
<b>Total</b>	652	194 $\pm$ 159	1	564

Values within a column followed by different superscript letters are significantly different ( $P < 0.05$ )

production in second and third parities and the effect of age of dam on culling decision. So, dairy managers often try to keep younger and high producing cows in the herd if culling is not urgent.<sup>16</sup>

In conclusion, low percentage of voluntary culling and high percentage of involuntary culling due to health disorders especially digestive tract disorders in Iranian dairy herds could contribute to economic loss. Therefore, precaution measures should be taken into consideration for minimizing these kinds of costly culling through management approach to enhance dairy cows' nutritional and health performance in the herds.

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