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Disposal pattern of young Sahiwal cattle under organized farm

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ABSTRACT

Data of 830 female Sahiwal calves, born between 1986 and 2009 at National Dairy Research Institute's Farm, were analysed to study the influence of different non-genetic factors on disposal pattern (mortality and culling) of young Sahiwal cattle up to age at first calving (AFC) under organized herd. Different non-genetic factors like season of birth, period of birth and birth weight of calves were considered to assess their influence on mortality and culling. Overall disposal up to AFC was 33.78%, comprising 24.67% due to mortality and 9.11% due to culling. Maximum mortality was observed during first month of age, which was attributed to higher incidence of pneumonia and enteritis encountered in this age group. Mortality rate revealed a decreasing trend along with the age. Maximum culling rate was found during 12 month to AFC age group. Season of birth had highly significant influence on incidence of mortality during first month of age, whereas period of birth had significant influence on incidence of culling during 12 month to AFC age group. Birth weight of calves had no significant influence on either culling or mortality. The likelihood of mortality was higher in rainy and winter season born calves. The overall results showed that the major reason of female calves' disposal was mortality, especially during first month of age. Therefore, intensive care of calves of this age group against inclement weather conditions by providing better feeding and management would result in reducing mortality rate in calves.

Key words: Culling, Disposal pattern, Female calves, Mortality, Sahiwal

Young female dairy calves are used to replace unproductive/low productive animals of the herd. Therefore, the aim of any dairy manager/stockperson should be to include more number of young female animals into the milch herd regularly to maintain economic sustainability of enterprise. Singh (2001) and Abbas (2005) reported that nearly 2/3rd of total female calves born entered into milch herd and the remaining 1/3rd of female calves born were disposed prior to entry into milch herd. Furthermore, disposal rate during first lactation was around 18% in Sahiwal cattle (Abbas 2005, Upadhyay *et al*. 2014) indicating per year replacement rate of first calvers to maintain normal herd propagation. Female calves leave the herd due to 2 reasons i.e. culling and mortality. In usual practice, female calves are rarely culled but leave the herd because of their mortality or abnormality. Hence, knowledge regarding mortality of female calves is of vital importance to identify opportunities to improve the health status of calves (Svensson *et al*. 2006). However, references regarding the studies of disposal pattern of young Sahiwal cattle is limited. Keeping these views in mind, the present investigation was carried out to study the influence of different non-genetic factors on disposal pattern (mortality and culling) of young Sahiwal cattle up to age at first calving under organized herd.

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MATERIALS AND METHODS

Data source and structure: Data of 830 female Sahiwal calves born from 56 sires between 1986 and 2009, were used to analyze disposal, viz. mortality and culling pattern in various age groups. The data were collected from the records on Sahiwal cattle maintained at National Dairy Research Institute (NDRI), Karnal, Haryana, India. At the farm calves were weaned at the time of birth. Calves were fed colostrum for first 5 days and then whole milk was provided up to 30 days. Proper vaccination and deworming of calves is being followed at the farm. Post-mortem examination is routinely performed for the deceased animals at the farm. Therefore, reasons of death of calves were available at the farm. Auction of animals is performed at farm biannually and mostly during March and September. Therefore, culling records are also being maintained at the farm. For present investigation information on calf number,

sire number, dam number, date of birth of calf, birth weight, date of first calving, date of disposal and reason of disposal were collected from the farm records. Calf records with missing information on date of birth, birth weight and date of disposal were excluded from the study.

Traits and non-genetic factors studied: The traits analyzed in present study were culling rate and mortality rate during i^{th} age group (i= 0–1 mo., 1–3 mo., 3–6 mo., 6–9 mo., 9–12 mo. and 12 mo. to AFC). Calves were coded as 0 for staying and 1 for disposal either due to mortality or culling. The non-genetic factors considered in the present study to assess their influence on culling and mortality rate during i^{th} age group were season of birth, period of birth and birth weight of calves. Further, months were grouped into 4 seasons based on climatic conditions as winter (Dec to Mar), summer (Apr to June), rainy (July to Sep) and autumn (Oct to Nov). Years were grouped into periods of birth as 1986–1989, 1990–1993, 1994–1997, 1998–2001, 2002–2005, and 2006–2009. Birth weight of calves were classified as ≤ 15, 16–18, 19–21, 22–24 and ≥ 25 kg by using range interval of 2 kg derived by Sturge's (1926) rule.

Statistical analysis of data: The data analysis were carried out by Logistic regression model of Statistics Analysis System (SAS version 9.3) Programme. Non-genetic factors considered were season of birth, period of birth and birth weight of calves to assess their influence on mortality and culling during i^{th} age group (i= 0–1 mo., 1–3 mo., 3–6 mo., 6–9 mo., 9–12 mo. and 12 mo. to AFC). The following dichotomous logistic regression model was used:

$$\ln\left[\frac{p}{1-p}\right] = \beta_0 + \sum_{j=1}^{c} \beta_j X_j$$

Where, ln denotes the natural logarithm, p is the probability that the dependent variable equals a case, $ß_0$ is the intercept from the linear regression equation (the value of the criterion when the predictor is equal to zero), $ß_jX_j$ is the regression coefficient multiplied by some value of the predictor. The test of significance of linear regression coefficients ß was based on sum of square type I tests (Wald Chi square values). Logistic regressions work with odds rather than proportions. The odds are simply the ratio of the proportions for the 2 possible mutually exclusive events. If p is the proportion for one event, then (1– p) is the proportion for the alternate event; Odds = p / (1–p).

Definition of disposal pattern: Mortality pattern were classified into 8 groups, based on post-mortem findings of deceased calves, and these were: enteritis, pneumonia, pneumo-enteritis, toxaemia, cardio-vascular problems, general debility, unreported causes and miscellaneous causes. Cardio-vascular problems were defined as cardiac arrest, cardiac failure and anaemia. Miscellaneous causes of mortality were defined as colibacillosis, dehydration, colisepticemia, premature birth, anorexia, cold sock, congenital infection, snake bite, heat stroke, hepatic abscess, naval infection, fibrinous peritonitis, nitrate poisoning, tympany, trypanosomiasis, umbilical hernia, encephalitis and tetanus. The definition of culling pattern used in this study is depicted in Table 1.

Table 1. Definition of culling pattern

Culling pattern	Definition
Poor growth	Very low daily weight gain and weakness
Reproductive problems	Irregular oestrous cycle, anoestrous, cystic ovary and repeat breeder
Physical deformity	Partial blindness and defective limbs
Surplus	Extra animals
Miscellaneous	Off bred, skin infection, freemartin, transfer for research purpose

RESULTS AND DISCUSSION

The results revealed that the overall disposal of female calves up to AFC was 33.78%. Out of which 24.67% of female calves left herd because of mortality (Table 2) and 9.11% because of culling (Table 3). Lower estimates of mortality rate up to AFC in comparison to the present study were reported by some workers, with the value ranging from 13.70 to 17.52% (Singh *et al.* 2002, Atrey *et al*. 2005, Shahi and Kumar 2006). The estimate higher than that of the present study was reported by Banik and Naskar (2006) in

Table 2. Mortality incidence (%) due to various reasons in various age groups of Sahiwal female calves

Mortality reasons	Age group of female calves (mo.)						
	0–1	1–3	3–6	6–9	9–12	12-AFC	Birth-AFC
Enteritis	2.77 (23)	1.12 (8)	0.44 (3)	0.00 (0)	0.16 (1)	0.00 (0)	4.49 (35)
Pneumonia	3.49 (29)	0.56 (4)	0.44 (3)	1.06 (7)	0.16 (1)	0.81 (5)	6.52 (49)
Pneumo-enteritis	0.84 (7)	0.14 (1)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.98 (8)
Toxaemia	0.00 (0)	0.28 (2)	0.00 (0)	0.00 (0)	0.00 (0)	0.32 (2)	0.60 (4)
Cardio-vascular problems	0.60 (5)	0.14 (1)	0.00 (0)	0.00 (0)	0.16 (1)	0.00 (0)	0.90 (7)
General debility	2.65 (22)	0.84 (6)	0.15 (1)	0.61 (4)	0.00 (0)	0.00 (0)	4.25 (33)
Unreported causes	1.57 (13)	0.98 (7)	0.29 (2)	0.15 (1)	0.00 (0)	0.32 (2)	3.32 (25)
Miscellaneous	2.05 (17)	0.28 (2)	0.00 (0)	0.00 (0)	032 (2)	0.97 (6)	3.61 (27)
Total mortality	13.98 (116)	4.35 (31)	1.32 (9)	1.82 (12)	0.79 (5)	2.42 (15)	24.67(188)

Figures in parentheses indicate no. of observations.

Table 3. Culling incidence (%) due to various reasons in various age groups of Sahiwal female calves

Culling pattern	Age group of female calves (mo.)						
	0–1	1–3	3–6	6–9	9–12	12-AFC	Birth-AFC
Poor growth	0.00 (0)	0.00 (0)	2.05 (14)	1.82 (12)	1.11 (7)	0.81 (5)	5.78 (38)
Reproductive problems	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	1.45 (9)	1.45 (9)
Physical deformity	0.00 (0)	0.00 (0)	0.00 (0)	0.15 (1)	0.00 (0)	0.16 (1)	0.31 (2)
Surplus	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.32 (2)	0.32 (2)
Miscellaneous	0.12 (1)	0.00 (0)	0.00 (0)	0.15 (1)	0.00 (0)	0.97 (6)	1.24 (8)
Total culling	0.12 (1)	- (0)	2.05 (14)	2.12 (14)	1.11(7)	3.70 (23)	9.11(59)

Figures in parentheses indicate no. of observations.

Table 4.Influence of various non-genetic factors on likelihood of mortality of Sahiwal female calves (expressed in terms of odds ratio)

Explanatory variable	Age group of female calves (mo.)					
	0–1	1–3	3–6	6–9	9–12	12-AFC
Season	**	NS	NS	NS	NS	NS
Winter	2.680	0.547	>999.000	0.483	0.231	>999.000
Summer	1.298	0.851	>999.000	2.110	0.313	>999.000
Rainy	3.415	0.734	>999.000	0.424	1.382	>999.000
Autumn	1.000	1.000	1.000	1.000	1.000	1.000
Period	NS	NS	NS	NS	NS	NS
1986–1989	1.101	0.885	<0.001	<0.001	<0.001	0.565
1990–1993	1.978	0.243	<0.001	<0.001	<0.001	<0.001
1994–1997	2.744	1.803	2.787	<0.001	1.059	<0.001
1998–2001	1.472	1.426	1.434	0.724	<0.001	0.803
2002–2005	1.514	0.603	0.835	0.984	0.805	0.385
2006–2009	1.000	1.000	1.000	1.000	1.000	1.000
Birth weight (kg)	NS	NS	NS	NS	NS	NS
≤ 15	5.706	0.173	<0.001	0.391	>999.000	>999.000
16–18	2.239	0.205	0.447	0.144	>999.000	>999.000
19–21	2.214	0.236	0.412	0.287	>999.000	>999.000
22–24	1.948	0.202	0.404	<0.001	>999.000	>999.000
≥ 25	1.000	1.000	1.000	1.000	1.000	1.000

** Significant at 1% level (P<0.01); NS, nonsignificant at 5% level (P>0.05).

Sahiwal as 35.6%. In earlier studies conducted on various exotic and crossbred cattle, culling rate up to first calving was higher (11.57–31.05%) than that of present study (Singh *et al.* 2002, Atrey *et al*. 2005, Shahi and Kumar 2006, Saha *et al*. 2012).This could be due to better adaptability of indigenous cattle than that of exotic and crossbred cattle to Indian tropical climatic conditions. Age group wise mortality and culling revealed that there was maximum mortality during one month of age (13.98%) and maximum culling during 12 months to AFC age group (3.70%). Mortality rate showed decreasing trend as the age advanced, whereas, the culling rate had an increasing trend along with the age. Increasing trend of culling rate with the age in female calves might be attributed to expression of physical attributes along with the age.

Mortality and culling pattern in various age groups are depicted in Tables 2 and 3, respectively. It revealed that major reason of mortality of female calves was pneumonia (6.52%), followed by enteritis (4.49%) and general debility (4.25%). Nehara (2011) in Karan Fries (crossbred of Holstein Friesian and Tharparkar cattle) also reported major reasons of female calf mortality as pneumonia and enteritis. Higher incidence of these problems was noticed during one mo. of age. Maximum mortality during the one mo. of age may be attributed to higher incidence of pneumonia, enteritis and general debility encountered in this age group. Major reasons of culling in females were poor growth (5.78%) and reproductive problems (1.45%). Maximum culling due to poor growth was done during 3–6 mo. of age (2.05%), whereas culling due to reproductive problems was found to be during 12 mo. to AFC age group (1.45%).

In the present study, non-genetic factors considered to

Table 5. Influence of various non-genetic factors on likelihood of culling of Sahiwal female calves (expressed in terms of odds ratio)

Explanatory variable	Age group of female calves (mo.)					
	0–1	1–3	3–6	6–9	9–12	12-AFC
Season	NS	-	NS	NS	NS	NS
Winter	1.598		0.192	>999.000	<0.001	0.932
Summer	>999.000		0.667	>999.000	0.769	1.229
Rainy	1.639		0.147	>999.000	<0.001	0.696
Autumn	1.00		1.00	1.00	1.00	1.00
Period	NS	-	NS	NS	NS	*
1986–1989	7.425		7.228	1.639	1.158	15.734
1990–1993	2.815		9.773	2.889	0.588	5.950
1994–1997	2.639		3.987	1.904	<0.001	1.291
1998–2001	3.156		6.044	1.594	0.562	3.260
2002–2005	>999.000		<0.001	1.133	0.272	3.381
2006–2009	1.00	-	1.00	1.00	1.00	1.00
Birth weight (kg)	NS		NS	NS	NS	NS
≤ 15	0.434		<0.001	1.411	0.765	>999.000
16–18	>999.000		1.224	>999.000	0.647	>999.000
19–21	0.576		1.278	>999.000	>999.000	>999.000
22–24	0.829		0.503	>999.000	>999.000	>999.000
≥ 25	1.00	-	1.00	1.00	1.00	1.00

* Significant (P<0.05); NS, nonsignificant (P>0.05). -, no culling was observed during 1 to 3 mo. of age group.

assess influence on incidence of mortality and culling during i^{th} age group (i = 0–1 mo., 1–3 mo., 3–6 mo., 6–9 mo., 9–12 mo., 12 mo.-AFC) were season of birth, period of birth and birth weight of calves. The incidence of culling and mortality in various age groups with respect to various non-genetic factors is depicted in Tables 4 and 5, respectively. The results envisaged that season of birth had highly significant influence (P<0.01) on mortality during one mo. of age and period had significant influence (P<0.05) on culling during 12 mo. to AFC age group; whereas, influence of other factors on culling and mortality in various age groups was nonsignificant (P>0.05). The likelihood of mortality in female calves was higher in female calves born during rainy and winter seasons and the likelihood of mortality was least during the autumn. Higher likelihood to die during rainy and winter seasons may be attributed to higher incidence of enteritis and pneumonia, respectively encountered in calves born in these seasons. Among the culling during 12 mo. to AFC age group, the likelihood of culling was maximum during the first period (1986–1988), thereafter it decreased up to third period (1994–1997). The variation in culling rate over the periods may be attributed to change in culling policies and variation in environmental factors over the periods. Mukherjee and Tomar (1999) observed significant influence of season and period of birth on mortality rate during 0 to 1 mo. and 6 mo. to AFC age groups in Brown Swiss crossbreds.

The present observation indicated that pneumonia and enteritis, especially during one mo. of age, were the main causes of mortality for which female calves were disposed of from the herd. The likelihood of calves to die was higher in rainy and winter season born calves. Therefore, intensive care of calves of this age group against inclement weather by providing better feeding and management would result in minimizing mortality rate in calves. A few female calves also left the herd because of culling and maximum culling rate was found during 12 mo. to AFC age group. Therefore, female calves especially heifers also need attention for reducing culling due to poor growth and reproductive problems like late maturity by providing good feeding and management.

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