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Full Length Research Paper

Studies on the calf mortality pattern in Gir breed

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This study aims to investigate calf mortality pattern in Gir breed. Research data were collected from the records of Gir herd, maintained at Kasturba Gandhi National Memorial Trust, Dairy Farm Kasturbagram Khandwa Road, Indore M.P., covering a period of 16 years (from 1994 to 2009). The period-wise distribution of calf mortality showed that highest mortality rate (18.9%) was recorded in period P₄ (2006 to 2009) and the lowest (9.8%) in period P₂ (1998 to 2001). Age-wise distribution of calf mortality showed that it was highest (5.4%) in 0 to 1 month age group in both sex. The lowest mortality was observed in 3 to 6 months of age group, which might be due to better management practices given to this age group. The mortality rate from 1 to 3 months and 6 to 12 months age group was also calculated and the values of mortality rate as 3.6 and 4.4% respectively. Sex-wise distribution of calf mortality indicates that out of total 208 male calves, 34 calves (15.9%) died, whereas, out of 196 female calves, a total of 27 calves (14.3%) were reported to be dead. Season-wise distribution showed that the highest calf mortality (5.7%) was determined in those calves born in the winter season. The overall mortality rates due to parity of the dam were 7.2, 4.5, 1.4 and 2.8% respectively for first, second, third and fourth calving. The highest mortality in Gir calves was recorded due to gastroenteritis (6.2%) followed by pneumonia (3.2%), insufficient or delayed colostrums feeding, handling causes and worm infestation (3.6%). Gastroenteritis as the prime cause of mortality could be synchronized with the results of high mortality rate in Gir calves during winter season in this investigation.

Key words: Mortality rate, calf mortality, gastroenteritis, pneumonia.

INTRODUCTION

Mortality of calf is an important trait both for breeding and economic point of view in dairy enterprise. A high survival rate in a dairy herd helps increase the selection difference which is one of the main factors controlling genetic gain and more economic returns. When Kankrej cattle were studied, it was observed that calf mortality below one month of age was 19.17%, while 53.6% of death occurred before two months of age. Mortality was higher in male than female calves and was lower in

summer than in winter or monsoon season. The aim of the present study was to evaluate the Gir cattle in respect of survivability of young stock and suckling behavior of different sex up to 15 days of their life for bringing about improvement in overall efficiency. Gir is one of the well described dairy breeds of India with a good survival and reproductive performance. The home tract of this breed is Gir forests of South Saurashtra in Gujarat. It is found in more or less pure form all over Saurashtra and in the

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Table 1. Calf mortality according to period of the year.

Period	Male			Female			Overall mortality		
	No. of birth	Total no. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)
P1	56	8	14.28	40	7	17.5	96	15	15.62
P2	49	8	16.32	63	3	4.76	112	11	9.82
P3	47	7	14.89	33	6	18.18	80	13	16.25
P4	56	13	23.21	60	9	16	116	22	18.9
Chi-square value		1.97 ^{NS}			4.96 ^{NS}			4.43 ^{NS}	

NS=non significant.

Table 2. Calf mortality according to age and sex in Gir.

Age (Month)	Male			Female			Overall mortality		
	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)
0-1	208	12	5.76	196	10	5.10	404	22	5.44
1-3	196	8	4.02	188	6	3.19	387	14	3.61
3-6	188	6	3.14	182	3	1.64	373	9	2.41
6-12	182	7	3.78	179	9	5.02	364	16	4.39
Overall		15.86			14.28			15.09	
Chi-square value		2.05 ^{NS}			9.29*			5.97 ^{NS}	

* Significant at P<0.05.

adjoining areas of Maharashtra, Rajasthan and Madhya Pradesh.

establishment of herd might be due to small number of population in the dairy herd.

MATERIALS AND METHODS

The data of present study were collected from the records of Gir herd, maintained at Kasturba Gandhi National Memorial Trust, Dairy Farm Kasturbagram Khandwa Road, Indore M.P., covering a period of 16 years from 1994 to 2009.

The total period of the calf mortality was divided into four (P1 = 1994 to 1997; P2 = 1998 to 2001; P3 = 2002 to 2005 and P4 = 2006 to 2009). The year was divided into four seasons (Winter = October to January; Summer = April to June; Rainy = July to September and Spring = February to March). The parity of dam was determined as first (Pty-1), second (Pty-2), third (Pty-3) and fourth onwards (Pty-4).

RESULTS AND DISCUSSION

Mortality rate according to different period of the year

The calf mortality showed that the highest mortality rate (18.9) was recorded in P4 (2006 to 2009), which included 23.21 and 16.00% in male and female calves respectively, whereas, the lowest (9.82%) was determined in P2 (1998 to 2001), which included 16.32 and 4.76% in male and female calves, respectively (Table 1). The lowest percentage of calf mortality in second phase of

Mortality rate according to age and sex

The mortality rate in the first month of life was highest (5.44%) in both sexes (Table 2). In other words, the calves were more susceptible to the diseases and other environmental stresses in this group. This 0 to 1 month period is the most crucial stage of the calf life and it is seen that after this period the chances of survival of calves get maximized. The overall mortality percentage in 1 to 3 months of age group was 3.61% (4.02% in male and 3.19% in female). The overall mortality rate in 3 to 6 months age group was 2.41%. The percentages of mortality in male and female calves were calculated to be 3.14 and 1.64%. However, lower estimates than present finding was recorded by Kumar et al. (2002a) in organized dairy farms of Andhra Pradesh. The mortality rates from 6 to 12 months of age were also calculated and the values were 4.39% (3.78 and 5.02% in male and female calves, respectively). The Kambaj et al. (2006) in buffalo calves was reported to have an overall mortality rate of 14.59% which is higher than that of our present finding. The results indicate that the mortality in the first half was almost double than that recorded in second half of a year of calf's life. Sex-wise distribution of calf

Table 3. Calf mortality according to season of birth.

Season	Male			Female			Overall mortality		
	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)
Winter	208	14	6.73	196	10	4.59	404	24	5.69
Summer	194	12	6.18	187	7	3.74	381	19	4.98
Rainy	182	5	2.74	180	5	2.77	362	10	2.68
Spring	177	5	2.82	175	4	2.28	352	8	2.55
Chi-square value		5.55 ^{NS}			4.19 ^{NS}			9.19 [*]	

* Significant at P<0.05; NS= Non significant.

Table 4. Calf mortality according to season of death of calf.

Season	Male			Female			Overall mortality %		
	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)
Winter	208	13	6.25	196	6	2.55	404	19	4.45
Summer	195	11	5.64	190	7	3.66	385	18	4.66
Rainy	184	8	4.34	183	7	3.80	367	15	4.07
Spring	176	5	2.84	176	5	2.82	352	9	2.83
Chi-square value		2.88 ^{NS}			0.419 ^{NS}			4.19 ^{NS}	

^{NS}=non significant.

mortality indicates that out of a total 208 male calves, 33 calves (15.86%) died, whereas, out of 196 female calves, a total of 28 calves (14.28%) were reported to be dead. The reason for higher percentage of death in male calves than in females, might be due to the fact that for the want of milk, better care and management practices would have been adopted for raising of females, whereas, male calves might be ignored. In the present study, the overall average mortality in Gir calves were found to be 15.09%, however, Sreedhar et al. (2010) found a higher mortality rate (19.5%) in buffaloes.

Mortality rate according to season of birth

Season-wise distribution showed that the highest calf mortality rate (5.69.0%) was determined in those calves born in the winter season (October to January). The percentage of mortality in male was recorded as 6.73%, whereas, that of female calves was 4.59% during winter season. The lowest percentage of mortality was recorded during Rainy (July to September) and Spring (February to March) (Table 3). Similar findings were reported in calves by Kumar et al. (2002b) in Ongole calves.

Mortality rate according to season of death

The overall mortality was found to be highest in summer

(4.66%), probably due to excessive ambient temperature and scarcity of green feed and fodder. Ghosh et al. (1996), in different breeds and their crosses reported similar lethal effect of the summer on calves mortality rate. In the present study, a higher mortality rate in male (5.6%) than female (3.7%) was determined (Table 4).

Mortality rate according to different parity of dam

The sequence of lactation play important role in the mortality of Gir calves. The parity of dams had significant effect ($p<0.01$) on the mortality rate in female calves. The overall mortality rate due to parity was found to be 7.17, 4.54, 1.40, 2.84% in pty-1, pty-2, pty-3 and pty-4 onwards parities respectively. The decreasing trend of calf mortality with the subsequent deliveries reveals that as the dam have more calving, it becomes experienced in rearing the calves (Table 5).

Mortality rate according to causes of diseases

The highest mortality in Gir calves was recorded due to gastroenteritis (6.18%), which was due to bacterial or viral infections, or due to delayed feeding of colostrums to the calves (Table 6). Balvir et al. (2009) observed gastroenteritis (7.30%) as major causes of mortality followed by pneumonia and others. In our study, pneumonia

Table 5. Calf mortality according to parity of dam in Gir.

Parity	Male			Female			Overall mortality		
	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)
Pty-1	208	14	6.25	196	15	7.65	404	29	7.17
Pty-2	194	11	5.64	181	6	3.35	375	17	4.54
Pty-3	183	3	1.63	175	2	1.15	358	5	1.40
Pty-4	180	7	3.86	173	3	1.75	353	10	2.84
Overall		6.25			7.65			7.67	
Chi-square value		7.0 ^{NS}			15.18**			19.18**	

**Significant ($p < 0.01$), NS=non significant.

Table 6. Calf mortality rate (%) according to causes of disease.

Period	Male			Female			Overall mortality %		
	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)	No. of birth	No. of death	Mortality (%)
Gastroenteritis	208	12	5.79	196	13	6.63	404	25	6.18
Pneumonia	196	9	4.59	183	3	1.63	379	12	3.16
Tympany	187	3	1.86	180	2	1.11	367	5	1.36
Septicaemia	182	3	1.64	177	0	-	359	3	.83
Others	179	7	3.91	177	5	2.80	356	13	3.65
Chi-square value		12.06*			27.66**			31.96**	

*Significant ($p < 0.05$); **significant ($p < 0.01$).

was found to be the second important cause of calf mortality with 3.16%. Similar findings were observed by Patgiri et al. (1987) in Kankrej x Jersey calves, whereas, Islam et al. (2005) observed pneumonia as major cause of calf mortality in Bangladesh. Insufficient or delayed colostrum feeding, handling causes, worm infestation, snake bites etc. were found to be the third reason of calf mortality, which resulted in 3.65%. Handling causes includes unhygienic condition of shed, incorrect knowledge about care and management of new born calf, improper protection against unfavorable condition and defective management practices. Verma et al. (1996) also observed that timely and required amount of colostrum feeding to neonatal calves resulted into lower incidences of death. The percentages of mortality due to tympany, hepatitis and septicemia were found to be 1.36, 0.80 and 0.83 respectively, with similar mortality rate in new born calves.

Conclusion

The influences of period, age, sex, season of birth, season of death, parity of dam, causes of diseases and sires on mortality rate of Gir calves have been investigated. The sex and season of death do not have any significant influence on the calf mortality rates. However, the age, season of birth, parity of dam and

diseases has highly significant effect on the mortality rates in Gir calves.

Conflict of Interest

The authors have not declared any conflict of interest.

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Full Length Research Paper

Welfare issues of calf management practices in small scale dairy farms, Ratnapura District, Sri Lanka

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Public concern on welfare of dairy calves remains low in Sri Lanka. Therefore, a survey was conducted to assess the welfare issues of dairy calf management practices in 120 small scale dairy farms (herd size 7.85 ± 3.25 : Mean \pm SD) in Ratnapura district, Sri Lanka. Farmers were selected by using multistage random sampling technique and data collection was performed by the interview with the farmer using a questionnaire. Analysis was based on descriptive statistics. In 84% of farms, separate calving pen was absent. Cows were not provided bedding materials during calving in 22% of farms. In 16% of farms, disinfection of the new born's navel was not practiced. All the farmers did not concern on colostrum quality, quantity and quickness of feeding. In 53% of farms, calf sheds were in poor condition (slippery floors- 13%, floor with obstacles- 53%, no side walls- 63%, poor condition of roof- 20%, no drainage facilities- 47%). However, 5% of farmers did not provide shelters for calves. Use of sick pen and provision of exercise yard were not in practiced in all the surveyed farms. In addition, in 44% of farms, calves were not provided grazing or any other exercises. Results indicated that 11% of the farmers did not treat calves for wounds or cuts. Furthermore, 9% of the farmers did not practice deworming and 92% of the farmers did not treat for external parasites. All the farmers did not concern about the quantity and quality of the feeding materials. Disbudding was practiced in 11% of farms without pain relief techniques. In overall, results reveal that there are issues in management practices that need intervention strategies to improve the welfare of dairy calves in the area.

Key words: Dairy calf, small scale farms, welfare issues, management practices.

INTRODUCTION

When rearing animals, animal welfare is one of the most vital aspects that need to be considered by the farmers. According to the Fraser et al. (1997) welfare of animals typically includes three questions: Is the animal functioning well (e.g., good health, productivity etc.)? Is the animal feeling well (e.g., lack of pain etc.)? and is the

animal able to live according to its nature (e.g., performs natural behaviors that are thought to be important to it, such as grazing)?

Animal welfare assessment needs to cover all three areas of concerns. There are recommendations in calf management practices such as the timing of cow-calf

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separation, the amount of milk that is provided, when and how solid food and water are provided, the ways calves are housed and the age and methods by which they are weaned and dehorned (Weary and Chua 2001). Other than those, painful procedures, pleasure and naturalness such as accessing to the pasture are also included when concerning the calf welfare. Neglect of the welfare of the calves could lead young calves are vulnerable to disease, often fail to gain weight and experience high levels of mortality (Place et al., 1998). Ultimately, this may badly effect on the productivity and continuity of the herd. Therefore, it is necessary to find out if there are many of facilities provided for the calves by farmers or not under small scale production system. Present study evaluates the welfare issues of calves in small scale dairy farms with reference to the major management practices.

MATERIALS AND METHODS

In this study, calf management practices were surveyed on 120 small scale dairy farms (herd size 7.85 ± 3.25 : Mean \pm SD) that were distributed throughout Ratnapura district during the period of May, 2013 to February, 2014. Farmers were selected by using multistage random sampling technique. Data collection was performed by the on farm survey included a face to face interview with the farmer using a pre tested self administered questionnaire. The questionnaire was divided into seven categories of management practices that could affect calf welfare: (1) Calving and newborn calf management; (2) Housing; (3) Feeding; (4) Cow-calf separation (Weaning); (5) Injuries, disease and parasitic control (6) Providing exercise and facilitate natural behaviours, and (7) Painful procedures and application of pain relief techniques when necessary. The answers to the questions were qualitative nominal (e.g., yes or no), qualitative ordinal (e.g., scale of answers from 1 = very good to 4 = bad), or continuous (e.g., an amount of water and feed supply per day, the length of the rope used to tie the calf etc.).

Statistical analysis

Means and standard deviations of all data were analyzed descriptively using Minitab 14.0 version.

RESULTS AND DISCUSSION

When considering the cattle breeds reared, most of the farmers reared Friesian-Sahiwal crosses and Jercy-sahiwal crosses. Friesian-Jercy crosses were also popular among the farmers. However, only 3 farmers reared indigenous breeds.

Calving and new born calf management

The condition of the calving area affects health hazards of the new born calf. In this study, 84% of farms did not use separate calving pen and calving was occurred at the cow shed. Use of bedding materials in the calving area was practiced by 77% of farmers (Straw- 60%, dried

grass- 17%, mixed straw and dried grass- 19%, dried banana leaves- 3%) while 22% of farmers did not provide beddings during calving. Intervention of farmers in removal of naval cord of the new born calf was very low (9%). However, Tincture of iodine was used by 19% of the farmers and Neem (*Azadirachta indica*) oil was used by 61% of farmers to treat the naval cord of the calf while 4% of farmers used both tincture of iodine and Neem oil. There were 16% of the farmers that did not perform disinfection of new born calf's naval and this leads to suffering of the calves until the wound get cured naturally. Therefore, susceptibility to naval ill is very high under this condition. All the farmers were relied on the cow to provide colostrums and did not concern the colostrum quality, quantity and quickness of feeding. Bottle feeding or basket feeding of colostrums was not practiced in any of the farms. Majority of farmers (62%) allowed calves to suck colostrums once a day and followed by twice a day (31%) while 7% of the farmers allowed sucking three times per day.

Housing

Housing was one of the major areas when considering the calf welfare. According to Donovan et al. (1998), calf housing facilities should be designed to minimize injuries and stress and optimize health by providing adequate space, shelter from the sun, wind and rain, good ventilation and ease of handling. In this survey, 72% of the farms used group house, 20% of the farms reared calves in the cow barn, 2% of the farmers provided individual houses and 6% of farmers did not provide shelters for calves. Rearing calves individually results in higher weight gain or lower incidence of disease, and that it may reduce behavioral problems such as cross-sucking. However, calves are social animals and keeping dairy calves in groups may provide a number of advantages to both producers and their calves (Kung et al., 1997). Roof condition of the 14% shelters was at good condition and 65% of the calf shelters had medium roof condition. However, 21% of the shelters were with bad roof condition. Floor of calves shed shall be smooth but not slippery so as to prevent injury to the calves and so designed as not to cause injury or suffering to calves standing or lying on them. Majority of the farms in this study had rough floor with obstacles (53%) while there were 13% of slippery floors which affect on the well being of the calves. There was no use of side walls in 63% of farms. It caused to suffer calves from rain, wind and sun light. Regular cleaning and ventilation need to reduce the accumulation of urine, dung and ammonia (Woolums et al., 2009). Most of the farmers cleaned the shed twice a day (86%), in 5% of the farms sheds were cleaned three times a day while 9% of the farmers cleaned the shed once a day. Drainage facilities (slope of the floor of the shed, drainage lines) were not observed in 47% of farms

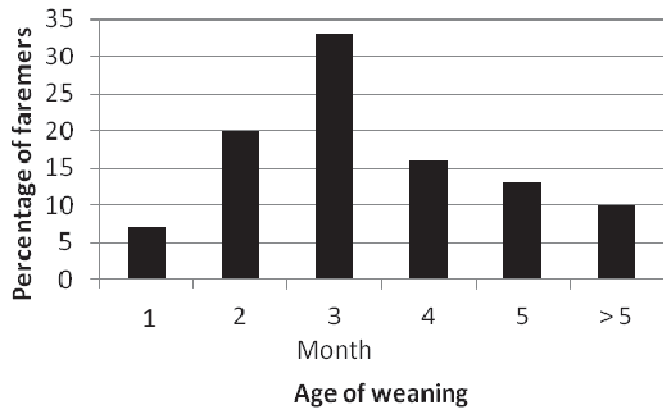


Figure 1. Age at weaning.

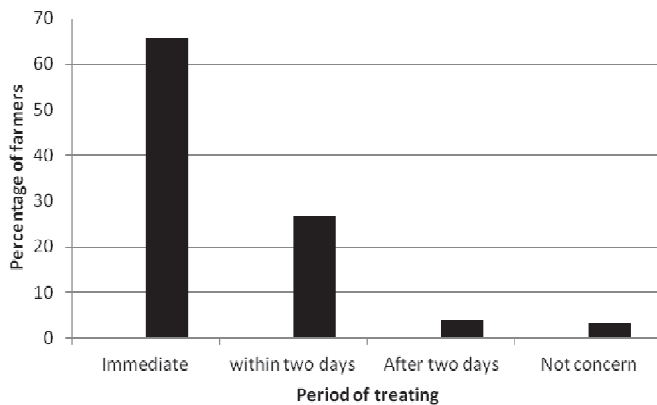


Figure 2. Period of treating the calves for diseases.

and in 32% of farms, drainage facilities were in poor condition.

Feeding

According to the five freedom guidelines of the animal welfare, animals should have freedom from hunger and thirst. According to the study it was found that after the colostrum feeding for three days, one quarter of the cow's udder was left remained without milking and calves were allowed to drink from this quarter. Matthewman (1993) reported that optimizing rumen development, fast growth and minimal stress and diseases at the early stage can be achieved by proper feeding to the calves with sufficient milk of 3 to 4 liters/day depending on the body weight. However, in those farms it was doubtful that whether the calves received sufficient milk according to their body weight. In all farms calves were introduced to the forages at the age of 7 to 10 days. Earlier introduction of forages to calves is necessary to stimulate rumen development and digestive enzyme activities. Majority of the farmers (56%) supplied forages three times per day.

However, all the farmers did not aware about the supply of forages according to the body weight of the calf. Therefore, it can be suggested that calves were fed with incorrect amount. Coconut poonac was the major source of concentrate. However, 25% of the farmers did not supply any of concentrate to the calves.

Dam - calf separation (weaning)

Weaning is an important intervention in the life of calf. Under natural conditions, weaning involves the gradual decrease in milk supply from the mother, and a concomitant increase in the intake of solid food by the young, which is accompanied by a gradual reduction in maternal-filial bond (Martin, 1984). In contrast, weaning of calves in conventional systems is usually abrupt and early compared to the natural process. As a consequence, the separation from the dam occurs without the completion of the period of learning and physiological adaptation to the new diet and group composition. At weaning, calf is subjected to multiple stressors such as the loss of the mother and access to the udder and milk, and changes in the social and physical environment (Newberry and Swanson, 2008). According to Brouček et al. (1995), the early separation of dam and calf has negative implications for the health of cow, calf diseases, high susceptibility to stress, and instability of the former social behaviour. Indicators of weaning stress include the high frequency of vocalizations emitted by the calf. Vocalizations by the young are thought to bring to mind about maternal care and the need to reunite with the dam (Newberry and Swanson, 2008). In surveyed farms, all the calves were gradually weaned and the most popular weaning age was at the age of 3 months (Figure 1). Moreover, in majority of the farms (93%), calves were tied in a separate area at the cow shed or near to the cow shed after weaning as allow the calves to see their mother and hear her voice. Therefore, those practices reduce the weaning stress to the calves.

Injuries, disease and parasitic control

Identifying sick animals in the early stages of disease is a crucial element for therapeutic success. Most of the farmers treated medically their calves immediately (66%) under sick condition while 3% of farmers did not treat the calves at all (Figure 2). From all the surveyed farms, 80% of the farmers reported to the veterinary office in any disease condition while others practiced indigenous treatments. However, there was no use of sick pen in order to separate the sick animals in all the surveyed farms. Moreover, 89% of farmers treated the calves for cuts and wounds and mainly used Betadine (Povidone-Iodine) and Negasunt powder (Amino Methyl Sulfonamide) while 11% of the farmers did not treat for injuries and this

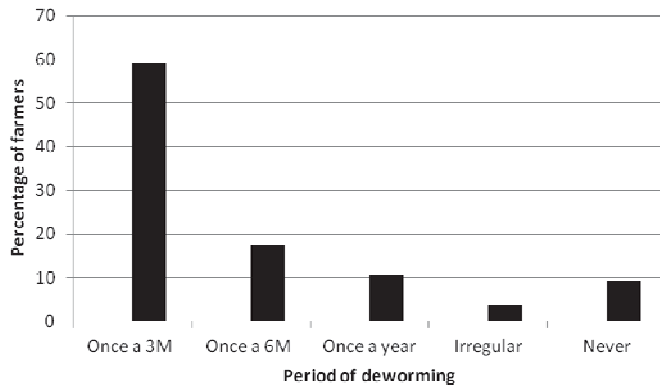


Figure 3. Period of deworming of the calves. 3M - Three months; 6M - Six months.

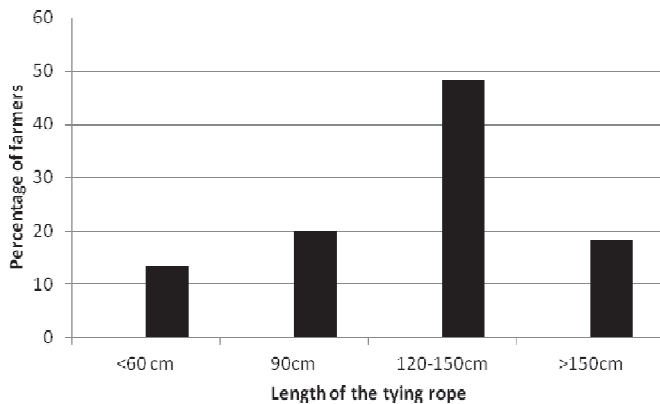


Figure 4. Length of the tying rope.

lead to suffering of the calves unnecessarily. Parasite control is an important consideration in the welfare of cattle and appropriate action should be undertaken to control and/or prevent parasitic infection. Deworming of the calves was practiced by 91% of the farmers (Figure 3). However, results revealed that farmers did not concern on periodical deworming. Moreover, 92% farmers did not treat the calves for external parasites.

Providing exercise and facilitating natural behaviors

Majority of the calves in the surveyed farms were tied in the shed or opened area for the whole day (84%). According to the Animal Welfare Guidelines, calves shall not be tethered with the exception of group-housed calves which may be tethered for the periods of not more than one hour at the time of feeding milk or milk substitute. However, none of the farm use exercising yard in the calf pen or provide exercise. According to Rushen et al. (2008), a calf needs an opportunity to do enough exercises (through running, jumping and playing with

others) to develop its muscles and bones. Playing around may also help calves to develop their social skills and explore behaviors (Jensen et al., 1998). Grazing is the natural feeding behaviour of calves. However, 44% of farmers did not allow the calves to graze and cut and fed method was practiced. Therefore, they were not provided any exercises. Grooming behaviour is very important to minimizing disease and parasitism. Therefore, calves need to be able to groom their whole bodies effectively. However, the length of the tying rope affects the ability of grooming the whole body. Majority of the farmers used 120 to 150 cm length rope to tie the calves (Figure 4). Calf needs to show sucking behavior in drinking colostrums or milk and if a calf does not obtain milk from a real or artificial teat, it sucks other objects (Broom, 1982; Jung and Lidfors, 2001). Results revealed that all the calves were allowed to suck colostrums and milk from their mother cow. Therefore, the amount of drink milk cannot be measured. Farmers did not have an idea about the satiety of calves. Therefore, allowing suckling is also a welfare issue when it concerns the hunger and satiety of calves. Calves need to rest and sleep in order to recuperate and avoid danger. Calves that have more rest in comfortable conditions grow better (Hänninen et al., 2005). Therefore, providing of bedding materials is very important in calf welfare. However, 68% farmers did not supply beddings for the calves to lie down or rest.

Painful procedures and application of pain relief techniques

Ear tagging was the most used method by the farmers (67%) to identify the calves. In addition, 4% of farmers used to call the calves by a name and 29% of the farmers did not use any method to identify their calves. Hot branding like painful procedure was not practiced in any of the farms. However, disbudding (removal of horn buds) with a hot iron rod was practiced in 12% of farms without using pain relief techniques. Stafford and Mellor (2005) suggested that all methods of dehorning and disbudding cause pain to calves and this can be shown with a variety of physiological and behavioral measures. None of the surveyed farmers practiced removal of extra teat in calves. Furthermore, none of the farmers used local anesthetics or analgesics to control pain in calves.

Conclusion

Results indicate that there were few management practices that not comply with the animal welfare. No use of separate calving pen, low intervention in calving and new born calf management, no use of shelters and inappropriate housing system, no use of exercising yard in the calf pen or not provide exercises, no use of sick pen, lack of knowledge on colostrum management,

forage and concentrate feeding, lack of concern on periodical deworming and external parasites, not providing of beddings and no use of pain control techniques were the main identified risk factors that affected on the welfare of calves in small scale dairy farms in Ratnapura district, Sri Lanka. Therefore, this survey helps to understand the management practices need to focus on the intervention strategy to improve welfare of dairy calves in the area.

Conflict of Interest

The authors have not declared any conflict of interest.

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