



SHORT COMMUNICATION

Management Practices of Calf Welfare at Dairy Cattle Farms in the Western Province of Sri Lanka

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ARTICLE INFO

Article history:

Received: 26 August 2024

Revised version received: 14 March 2025

Accepted: 19 March 2025

Available online: 01 July 2025

Keywords:

Calf rearing

Management practices

Risk factors

Welfare

Citation:

Weerasinghe, W.P.C.G., Rajapaksha, E. and Samarakone, T.S., (2025). Effect of Management Practices on Calf Welfare of Dairy Cattle Farms in the Western Province of Sri Lanka. *Tropical Agricultural Research*, 36(3): 242-251.

DOI:

<https://doi.org/10.4038/tar.v36i3.8772>

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ABSTRACT

A survey was carried out in 144 dairy cattle farms in the Western Province of Sri Lanka to identify management factors that affect welfare of dairy calves. A total of 392 calves were monitored in farms with the herd size of 5.4 ± 2.0 with milk production of 22.9 ± 12.5 L/day/farm. Among the calves, majority were Jersey (63.0%) and Friesian (33.0%) crosses. Risk factors were identified as, not using calving pens (100%), lack of naval disinfection (64.3 %), lack of calf pen (93.1%), dam-fed colostrum (100%), mortality (28.0% of farms), prevalence of hock wounds (39.9%) and diseases (53.4%). Concrete/cement was the prominent flooring category (93%) with considerably unfriendly footing (injurious 24.2%, slippery 51.0%, unclean 67.1%). Injurious floors significantly augmented hoof temperature ($P < 0.001$). Slipperiness and dirty floors positively ($P < 0.05$) affected on prevalence and severity of hock wounds by 14.5% ($P < 0.001$) and 59.6% ($P < 0.001$) respectively. Stockperson attitude varied with the age where and youths (19-30 years) concerned more about proper flooring (85.7%), calf-pen (6.9%), concentrate/roughage access (10-14 days after birth) (14.2%), welfare/nutrition (78.6%) and calf mortality than the adults and seniors. Welfare and ethical considerations towards male calves were satisfying with better weaning age (3.8 ± 0.9 months), concentrate supplement (0.58 ± 0.28 kg/day) and selling after six months of age (93.0%). However, both female and male calves were underweight for their corresponding ages. In conclusion, this study will assist in developing intervention strategies to improve calf welfare for the better raising of calves into a well grown cow.

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INTRODUCTION

Better management and identification of risk factors of dairy calves are necessary for their survival and productivity. The quality of calf rearing may impact the welfare of calves and the productive outcome of the future cow (Weary, 2001). Calves often face challenges such as isolation, milk restriction and weaning at an early age (Vasseur et al., 2012). Calving management, colostrum management, feeding, housing, health, and pain-inflicting procedures practised routinely in dairy farms are considered as some of the most significant areas of the welfare of dairy calves (Flower and Weary, 2001). Studies done on dairy calf rearing practices in dairy farms in North America, Brazil and Europe have identified main practices that need to be improved to achieve productive and animal welfare goals (Vasseur et al., 2010; Hötzel et al., 2014; Ellingsen, 2016). Similar information on dairy calf rearing practices in Sri Lanka remains limited (Bandara et al., 2015; Weerasinghe et al., 2020). In a recent study (Weerasinghe et al., 2020), which focused on the Mid-country dairy farms in Sri Lanka had identified risk factors of calves such as high mortality rate, higher preference of hock wounds, dam-fed milk feeding etc. Thus, this study focused on the identification of risk factors of calves in Western province (WP) Sri Lanka. A comprehensive study about the risk factors of calves in different zones in Sri Lanka, will help to improving proper welfare conditions and thereby increase dairy productivity. In this study, dairy cattle farms in WP were surveyed to acquire information on the most frequent management practices in relation to decisive points allied with reduced welfare of calves.

MATERIALS AND METHODS

Selection and description of herds

The survey was conducted in 144 dairy farms distributed in WP (Gampaha, Veyangoda, Negombo, Meepe, Dompe, Mathugama and Kaluthara), Sri Lanka to congregate data on calf management practices and welfare issues. Farms were randomly selected and a

total of 392 calves, reared in tie-stall housing system were observed.

Collection and description of data

The questionnaire which was used to gather data in Mid-country dairy farms in Sri Lanka (Weerasinghe et al., 2020) was used in the current study. Data were collected through the face to face interviews with farmers and by measuring calf-based and shed-based parameters. The questionnaire consists of nine groups of management practices namely, calving management and care of newborn, colostrum management, calf-dam separation, practicing painful management procedures, calf feeding, weaning, housing management, calf health management and handling and fate of male calves. Welfare attitudes of each farmer were evaluated and categorized into two as positive and negative, using the scoring system proposed by Weerasinghe et al. (2020).

Tracking high temperature create by wounds, hock wounds of all four legs of 392 calves were captured using FLIR T420 Infrared Thermography (IRT) camera (IR resolution 320 × 240 pixels; Minimum focus distance 0.4 m (1.31 ft.); Object temperature range -20 °C to +120 °C (-4 °F to +248 °F) 0 °C to +650 °C (+32 °F to +1202 °F). Number of wounds, the temperature of wounds, average hoof temperature and average skin temperature were observed using the thermal images. Data related to flooring characters (Hoof damageable flooring – Yes/No, Cleanliness – Yes/No, Slipperiness – 1-Good Grip, 2- Less Slippery, 3- Very Slippery) were also recorded for each bedding space of calves.

Statistical Analysis

Data gathered from questionnaire survey were managed and analysed using Excel computer program (Microsoft Office Excel® 2007) and IBM SPSS 23.0 version. A calf was considered as a statistical unit and the $P < 0.05$ was taken as the significance level. Descriptive statistics were used to elaborate farm characteristics, calf management practices and animal-based measurements. Relationship between farm characteristics and management practices with welfare

issues of calves were identified by employing Crosstabs/ Fisher's exact test, Mann-Whitney U-test and Correlation by Pearson/Spearman rank coefficient. Thermal images were analysed in FLIR tools+® software and number of wounds per calf was grouped into four categories (1-No wound, 2-Less wounded, 3-More wounded, 4-Severely wounded), according to their severity as described by Weerasinghe et al. (2020).

RESULTS AND DISCUSSION

Calving management and care of new-born calf

According to results, in WP, Jersey crosses were the most prominent (63.0%) genotype followed by Friesian (33.0%) and Ayrshire (4.0%) crosses as mentioned in Table 1. A similar occurrence of genotypes was observed in Mid-Country dairy farms as reported by Weerasinghe et al. (2020). Hence, it could be assumed that farmers in both regions prefer Jersey crosses.

According to Table 1, none of the farmer had not used calving pens being similar to the conditions reported by Weerasinghe et al. (2020). However 16% of farmers in Rathnapura district had used calving pens as reported by Bandara et al. (2015). This situation was not unique to Sri Lanka. As reported, a considerable percentage of farmers in worldwide were not aware of using calving pens. This percentage was 29.9% in USA (USDA, 2008) and 51.3% in Canada (Vasseur et al., 2010). According to the current study, technological monitoring system was not applied for calving area observations, instead farmers visited cows about to calve, two times in every 12 h, once during day and night. In Canada, this monitoring period was four times per day

(three times in day and once in night) and few percentage had used a camera to monitor calving (Vasseur et al., 2010). Regular observation of cows about to calve is required to make sure the support at calving if complexities occur, and to ensure receiving of first colostrum feeding by new born calf. Hence, the level of surveillance found in current study was insufficient for cows and calves. USDA (2008) also had pointed out that large number of calves were not born in the provided calving pens in United States due to lack of observations.

In the current study, naval disinfection was practised by less percentage of farmers (35.7%) highlighting another welfare issue. Tincture of iodine or Neem (*Azadirachta indica*) oil is used for naval disinfection. However, compared to Mid-Country (Weerasinghe et al., 2020), farmers in WP has proper awareness on naval disinfection.

Colostrum management and calf-dam separation

Based on the survey, 99.4% of farmers fed their calves within one hour and others (0.6%) within two hours after birth, with dam origin colostrum. For better absorption of immunoglobulin (Ellingsen, 2016), colostrum should be fed within first four hours of birth (Weaver et al., 2000). According to the results, timing of first colostrum was satisfied, but dam-fed colostrum was a major issue since the required quality and quantity of colostrum is difficult to measure (Vasseur et al., 2010; Zucali et al., 2016). This uncontrolled colostrum consumption was also observed in many previous research, for instance in Brazil, 40% (Santos and Bittar, 2015), in Chile, 48%

Table 1: Results related to calving and new-born calf management

Parameter	%
Calf breeds (%)	
- Jersey	63.0
- Friesian	33.0
- Ayrshire	4.0
Use of calving pens	No
Naval disinfection (%)	35.7

(Amor and Gallo, 2020) and in Mid-country of Sri Lanka, 99.5% (Weerasinghe et al., 2020). In the current study, none of the farmers had used pool and frozen colostrum. According to Godden, (2008), pooling should be discouraged as larger volumes of low-quality colostrum may dilute smaller volumes of higher-quality colostrum. Most European farmers used frozen colostrum for their calves (Godden, 2008) whereas no such practice is reported in Sri Lanka (Bandara et al., 2015; Weerasinghe et al., 2020).

According to the current study, delayed separation (after 24 hours from birth) was identified as a critical welfare issue (98.7% of farmers). This was comparable to the previous research observations in Sri Lanka (Bandara et al., 2015; Weerasinghe et al., 2020). Immediate calf-dam separation within short period of birth is recommended to reduce the stress due to cow-calf bond (Weary and Chua, 2000), for better colostrum intake (Flower and Weary, 2001), to reduce pathogen contact and disease transfer (Windsor and Whittington, 2010) and to harvest maximum amount of milk (Wagenaar and Langhout, 2007). On the other hand, the European Food Safety Authority (2006) identified separation from the dam as a main risk for calf welfare, because of the lack of maternal care. Later separation is generally recommended due to benefits such as improving natural behaviour with emotional benefits for both dam and calf (Marcé et al., 2011; Daros et al., 2014), better weight gain, improving udder and uterine health (Flower and Weary, 2001) of cows.

To reduce post-stress of separation, alternative method such as weaning into two stages can be applied. Using this method, the calf can stay with its mother, but refrain from sucking, due to use of a nasal flap or an udder net. A potential benefit of these two methods is that withdrawal and physical separation occur at two different times.

There are certain management practices that can be used to facilitate the transition (Chen et al., 2017). Feeding calves with more milk at higher frequencies during the days after separation has reduced vocalization of calves (Weary and Chua, 2000). It can also be

beneficial to separate more than one calf at a time, since calves with full social contact establish strong ties with their companions (Daros et al., 2014), which further reduces stress. However, at the end of any separation, the calves should be stress free, and the least stressful routine for the cow and calf should be practiced.

Practicing painful management procedures

Current study had identified only one farmer who practiced disbudding at the age of two months by himself using a hot iron without prior application of local anaesthetics. However, some medicines were given following the process as pain killers. Branding was forbidden in Sri Lanka (Animal Act No 29 of 1958, amended in 2017) and Duffield et al. (2010) stated that painful procedures that can be recognized by behavioural changes of cows and calves, are disbudding, branding, dehorning, teat removal and castration (Sumner et al., 2018).

Ear tagging is the recommended method for identification of calves. All farmers used ear tags, only for female calves, with no particular age of application (mostly within the age of 2–4 months) which was similar to previous findings (Weerasinghe et al., 2020) and practised with the help of a Veterinary Surgeon.

Calf housing

Individual sheds or pens allow the keeper to observe the health and level of feed consumption of each calf, and easy access to all necessary medical or management procedures (Relic and Bojkovski, 2010). Prevailing issues related to calf housing were mentioned in below (Table 2).

According to Table 2, only 6.9% of the farms used calf pens and it was slightly higher than previous findings of 2.0% and 3.8% as reported by Bandara et al. (2015) and Weerasinghe et al. (2020), respectively. However the majority of calves (93.1%) were reared closer to their mothers in cow barns itself without a separate calf area could be

harmful as it may lead to aggressiveness and dominant actions.

Table 2: Welfare issues related to housing management

Parameter	%
Use of calf pens (%)	6.9
Calves in cow sheds with their mother (%)	93.1
Floor type - smooth cement/rough concrete (%)	93
Use of bedding materials	38.2
Improper flooring conditions	67.1
Hoof damageable floors	24.2
Slippery floors	51.0
Outdoor grazing	68.2
Slightly higher skin temperature/ °C	35.6

Smooth cement/rough concrete floor types are the most prominent floor type of the surveyed farms (93.0%). Lack of use of bedding material (38.2%) (Grass-64.9%, Wood shavings/Straw-35.1) and improper flooring conditions such as dirty (67.1%), hoof damageable (24.2%), and slippery (51.0%) floors were listed in table 2, as housing management related risk factors of calves. However, these proportions were slightly lower than those values reported (40.7%, 45.6% and 75.8%, respectively) for Mid-Country (Weerasinghe et al., 2020). Calves were allowed for outdoor grazing (68.2%) for few hours (1-2 hrs) per day by some farmers and it may help to reduce the risk of transmitting of air borne diseases due to sharing of same air space (Vasseur et al., 2010). However, grazing without any shade could increase the skin temperature of calves and make them stressed. In the current study, slightly higher skin temperature (35.6 °C) (Table 2) was observed in outdoor grazing calves, than in calves housed indoor (31.5 °C).

Hock wounds and hoof temperature

The prevalence of hock wounds of calves was 39.9 % which was considerably low compared to the situation (83.4%) of mid country of Sri Lanka (Weerasinghe et al., 2020). The number of hock wounds per calf was positively correlated with bed length ($\rho=0.163$, $P=0.03$) and width ($\rho=0.165$, $P=0.030$). Moreover, floor slipperiness ($r = 0.371$, $P<0.001$) and floor dirtiness ($r = 0.237$,

$P<0.001$) were also positively correlated. Hence, the risk of being wounded was amplified with increase of those parameters. Crosstab evaluations indicated that wounds' severity was augmented by 14.5 % when the floor was getting more slippery. Floor dirtiness was also significantly associated ($P<0.001$) and contributed to 59.6% on wounds' severity. These observations are comparable with the previous findings by Weerasinghe et al. (2020). Prevalence of high hoof temperature may cause pain for calves and is a critical risk factor. Hoof temperature was significantly ($P<0.001$) associated with floor cracks where floor surfaces with cracks resulted in high hoof temperature of calves in the present study.

Calf feeding and weaning

Dam-fed milk was the main method of milk feeding practiced by farmers in WP (93.0%). However, this method cannot measure the quantity of milk that calf consumed and hence, calves might endure hunger or be overfed. A few farmers (7.0%) in the present study used bucket/bottle feeding of fresh whole milk where 4 L/calf/day was fed in two meals during their pre-weaned period. Pasteurized and untreated waste milk was not used by any farmer as reported by with previous findings (Bandara et al., 2015; Weerasinghe et al., 2020). However, use of untreated waste milk was reported in several studies (USA 31%: USDA, 2007, Brazil 35%: Santos, 2014, Chile 51.7%: Amor and Gallo,

2020) although it is associated with transmission of infectious pathogens and antibiotic resistance (Vasseur et al., 2012). Early access to grain and/or grain-based products, which are fermented in the rumen, is essential for development ruminal papillae (Khan et al., 2011). Concentrates need to be introduced to calves within 10-14 days of age (Good Agricultural Practices in Dairying, 2014) and only 17.8% of farmers of WP were aware of it. It was also revealed that more than the recommended amounts of concentrates were provided ($P=0.04$) for calves.

Water is a basic requirement and should be given *ad libitum* from birth or within few days of birth (Good Agricultural Practices in Dairying, 2014). A considerable proportion (44.8%) of farmers in WP, Sri Lanka were aware of water supplementation within a week. Phipps et al. (2018) reported that, in Northern Victorian farms in Australia, 35.8% of farmers failed to provide calves with access to water from birth and the mean age of access to water was 4.7 days. In Canada it was 2.7 days (Vasseur et al., 2010) and in United States it was at 15.3 days (USDA, 2008).

Weaning off milk is the first feed transmission of calves (Vasseur et al., 2010) and weaning at 8-12 weeks of age is the common practice (Marcé et al., 2011). In the current study, 46.0% of farmers weaned their calves at the age of three months and average age of

weaning was 114 days. The weaning age vary widely among countries, for instance 80 days in Chile (Amor and Gallo, 2020), 49 days in Canada (Vasseur et al., 2010) and 90-150 days in Brazil (Santos et al., 2015). Other improper feeding practices were also observed such as no separate feeder for calves (96.7%) and inappropriate feeder heights (64.3%) which could negatively influence on feed intake (Sweeney et al., 2010). Comparison of body weight of calves was with the standard calf weights given in Good Agricultural Practices in Dairying (2014) is illustrated in Figure 1.

According to Figure 1, calves were underweight at all stages observed, and the body weights were significantly lower in both crossbreds ($P<0.05$). This observation was comparable to the findings reported by Weerasinghe et al. (2020).

Calf handling, diseases and mortality

In the current study, none of the farmers used electric prods, hitting and kicking for handling of calves, and in case of sickness of calves, all farmers updated Veterinarians as early as possible. Good health refers to the absence of illness and pain, produced by routine management procedures and health management related welfare issues were listed in table 3.

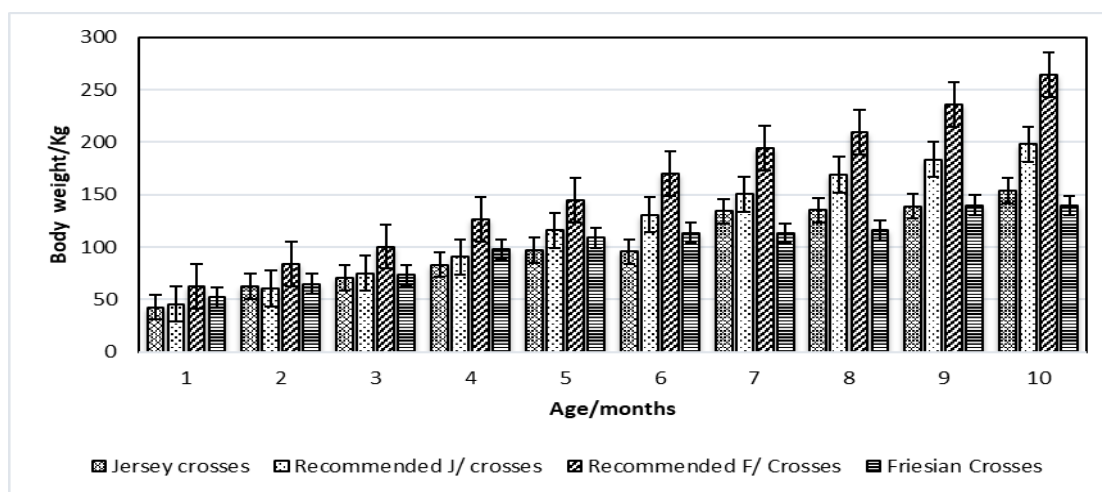
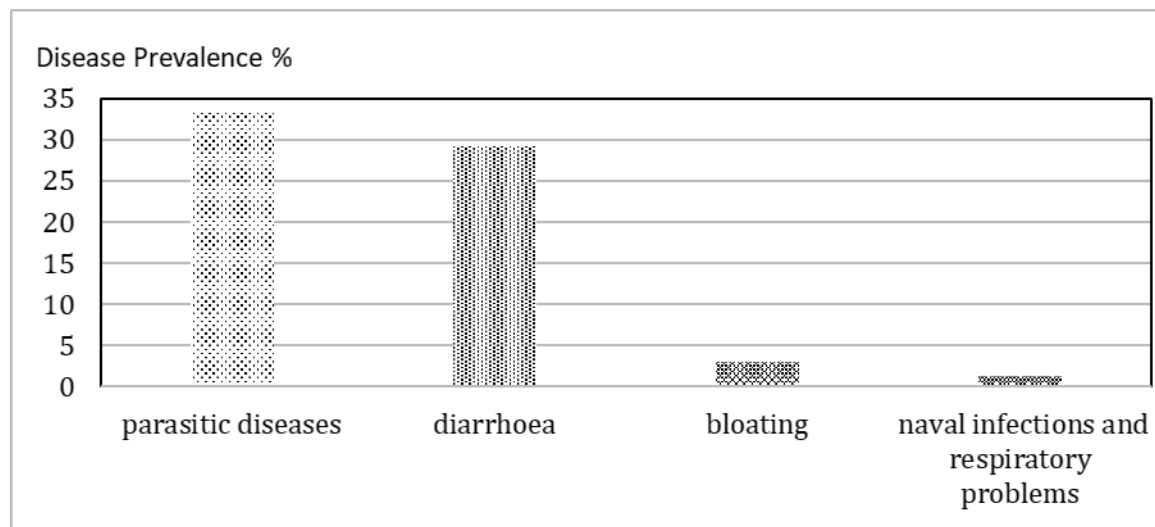


Figure 1: Mean bodyweight of experimental calves of two breeds, according to their age category (Error bars represent standard error)

Table 3: Welfare issues related to health management

Parameter	%
Calf deaths	28.0
Factors affect on calf mortality (%)	
- prevalence of diseases	62.7
- improper flooring	70.8
- poor knowledge of calf welfare	66.7
- Poor knowledge of calf nutrition	47.1

**Figure 2: Prevalence of diseases in calves**

According to above table (Table 3), a considerable percentage of calves were suffering from diseases (53.4%), among which parasitic diseases were common (33.3%) followed by diarrhoea (29.2%), bloating (3.1%), naval infections and respiratory problems (1.3%) as shown in Figure 2.

Diarrhoea and respiratory diseases are the most frequent health disorders of calves during their first 3 months of life (Guatteo et al., 2010). Windeyer et al. (2014) described an incidence of 23% for diarrhoea and 22% for respiratory diseases among Canadian dairy farms whereas Amor and Gallo (2020) reported a 15.5% and 13.7% (diarrhoea and respiratory diseases, respectively) in Chile. In the current study calf deaths were recorded in 28.0% of farms (Table 3) and mortality rate was higher than 5% per year in 39.2% of the farms. Several key areas were identified as causes of calf mortality (Table 3), such as the prevalence of diseases (62.7%), improper

flooring (70.8%), poor knowledge of calf welfare (66.7%) and nutrition (47.1%). Hence, awareness on the relationships between herd management practices and calf health and mortality could be used to modify their management practices as an attempt to reduce the calf deaths and disease incidences (Sivula et al., 1996; Seppä-lassila et al., 2016).

The fate of male calves

Welfare and ethical considerations of Sri Lankan farmers in the WP towards male calves were in a prominent position. Both male and female calves were managed by supplying all supplements (colostrum, concentrates, vitamins and milk feeding) and the majority (93.0%) were sold their male calves after six months of age. Many Western countries pay less attention and care towards male calves (Renaud et al., 2018). In Northern Victoria, Australia, the selling age was around 5.1 days for excess bulls and heifer calves (Phipps et al., 2018). The mean weaning age for male calves was in satisfactory condition

(3.8 ± 0.9 months) in WP farms with a better average concentrate feed intake per day (0.58 ± 0.28 kg) with a proper attention of Veterinary Surgeon whenever required.

Welfare attitudes and age group of farmers

In the present study, 39.5% of farmers exhibited a proper awareness of welfare which was significantly associated with floor cleanliness ($P < 0.001$) and fulfilment of nutritional requirements ($P < 0.001$). Farmers with positive welfare attitudes (54.1%) showed a good caring and management towards calves resulting zero mortality (81.2%), free from diseases (51.2%), absence of roof leaks (100%), absence of hoof damageable floors (41.9%), clean floor (78.5%), non-slippery floor (70.5%), proper ventilation (100%) and proper lighting inside shed (100%), compared to the farmers with negative welfare attitudes. The age group of farmers can be attributable to welfare attitudes with young farmers (18–30 years) who managed farms with proper flooring (85.7%), proper light/ventilation inside the shed (100%), providing calf pen (14.2%), concentrate/roughage access within 10–14 days (14.2%), zero mortality and good welfare and nutritional knowledge (78.6%) compared to adult (31–60 years) and senior (>60 years) farmers. Hence, experience level itself may help developing positive attitudes towards calf welfare, and knowledge building of farmers.

CONCLUSIONS

Factors that could diminish welfare of calves were identified as, lack of separate calf pens, not disinfecting the naval of new-born, dam-fed colostrum system and delayed-separation of cow-calf. Welfare issues related to the housing management practices were identified as floor slipperiness, dirtiness and damageable floors where those unacceptable flooring conditions were significantly associated with prevalence and severity of hock wounds and hoof temperature. Risk factors related to the feeding management of dairy calves were dam-fed milking, improper feed and water supplement, long weaning

period and underweighted calves. The issues related to health management and low awareness on welfare condition of calves are critical factors in calf welfare. Supplementation of adequate amount of concentrates, taking care of all calves equally, not using of pool colostrum or untreated waste milk, positive welfare attitude of stockperson and optimistic tendency of youth agers on dairy industry were observed as positive aspects. The study helped identifying intervention strategies necessary to improve dairy industry in Sri Lanka.

ACKNOWLEDGEMENT

The authors acknowledge - the generous support of dairy farmers in Western Province for facilitating to conduct the research by participating in the survey

FUNDING

This work was supported by the National Research Council of Sri Lanka (Grant No. NRC TO 14-10)

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