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Assessing farmer attitude on dry cow welfare in selected veterinary divisions in Kandy district, Sri Lanka

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ABSTRACT

Dry cow management practices influence on health, welfare and milk production of cows. Poor farmer–cow relationship and negative attitudes of the farmer on humane practices will reduce cow welfare and overall productivity. In this study, farmers' attitudes on key dry cow management practices and welfare were observed using a questionnaire in a face to face interview with forty dairy farmers in Kandy District, Sri Lanka. Collected data were statistically analyzed using SPSS version 23.0. The majority of the farmers were men (77.5%), whereas small-scale farming (87.5%) with part-time involvement (72.5%) were noticed. Critical risk factors of dry cow welfare such as no higher satisfaction about the industry (74.3%), poor awareness on concept of animal welfare (10%), hoof caring (42.5%), inspection of teats (10%), and deworming (30%) were identified. Male farmers were better than females in welfare-friendly attitudes for health (P = 0.033) and calving management (P = 0.018). Part-time farmers also had a significant impact on welfare positive attitudes towards calving and health management practices (P = 0.038, P = 0.013 respectively). Considerable percentage of farmers were uncertain on (Health management – 10.8%, Housing management – 18.8%, Feeding management – 15.0%, and Calving management – 5.6%) welfare-friendly routine. Hence, we suggest, further improvement to positive welfare attitudes towards dry cow management should be targeted via proper knowledge dissemination and education programs.

Keywords: Dry cow, Farmer attitudes, Management practices, Welfare

INTRODUCTION

Managing dry cows is one of the most complicated aspects of dairy farming. Optimal lifelong production for a dry period of 40-60 days was described by (Bachman and Schairer, 2003), whereas a dry period length of 53-76 days had suggested considering udder health and milk yield in the next lactation (Pinedo, Risco and Melendez, 2011). Moreover, the transition period is generally defined in academic and veterinary literature as 3 weeks before to 3 weeks after a cow gives birth to a calf (Mulligan and Doherty, 2008). During this period, the dry cow endures physiological, metabolic and immunological changes, and is at greater risk of increasing diseases, to the impairment of health, welfare and production (Mills and Keyserlingk, 2020). Animal welfare issues in this period are the source of stressors (Fujiwara *et al*., 2018). Better management during the dry period could maximize milk production, improve the health, welfare and profitability of dairy cows (Adler et al., 2019). Some of the most critical areas of dry cow management include routine practices of calving, housing, health management/ treatment, feeding, and welfare positive attitudes of farmer. The majority are not concern about treating animals humanly for

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better welfare and production rather focus on providing a favorable environment. Good stockmanship manipulates animal performance (Hemsworth 2003). The human-animal relationship has become one of the most extensively used concepts with reverence to explaining human influence on animal welfare (Cummins *et al.*, 2016).

The personality and attitudes of farmers are directly and indirectly allied with the welfare, productivity and management of cows (Adler et al., 2019). However, the information available on current dry cow management practices in Sri Lanka is limited. According to the authors' knowledge, there is no literature available on assessing attitudes of Sri Lankan dairy farmers toward dry cow welfare. This would help researchers assess the adoption of best practices and identify future research priorities. The objectives of the present study were the determination of farmers' attitudes on dry cow management practices and identification of the effect of farmer's profile (gender, age, full/part time involvement and experience) on their attitudes. Therefore, a survey was performed among dairy farms in Kandy district, Sri Lanka, to evaluate information on dry cow management practices that could hinder their welfare.

MATERIALS AND METHODS

Study location

The survey was carried out during the period of May to June 2021 in randomly selected 40 dairy farms in the veterinary divisions of Panvila, Pathadumbara and Kundasale which are located in Kandy district, Sri Lanka.

Study design

A questionnaire was developed in accordance with United State National Animal Monitoring System (NAHMS): General Dairy Management Questionnaire- 2014 (USDA-APHIS, 2014), BWAP-Bristol Welfare Assurance Programme-Cattle Assessment - University of Bristol- 2004, Cow-Calf health and handling assessment – UDC-2014, Codes of Recommendations for Welfare of Livestock: Cattle (England – 2003), RSPCA Welfare Standards for dairy cattle-2008 and Questionnaire identifying management practices surrounding calving (Cummins *et al.*, 2016).

Some topics were modified and new areas were added after discussing with field specialists to congregate more data. The new version of the questionnaire was pre- and time-tested before administered and the information was gathered with face to face interview with the farmer. The interviewee was the person who was responsible for dry cow management in the herd. The questionnaire consists of seven categories (1. Farmers' attitudes toward dairy cows, 2. Perception of cattle welfare, 3. Drying-off procedure, 4. Housing management, 5. Health management and handling, 6. Feeding management, 7. Calving management). Both close- and open-ended questions were included in the questionnaire. The rating scale, grouping and 5-point likert scale test (1 – Strongly agree, 2 – Agree, 3 – Neither agree or disagree, 4 – Disagree, 5 – Strongly disagree) were followed to ensure the homogeneity of data and reduce the subjectivity.

Statistical Analysis

Individual questionnaires were observed carefully to remove outliers and statistical analysis was conducted using SPSS 23.0 version. Descriptive statistics were calculated to observe farm characteristics/management practices and corresponding bar charts were generated using Excel 2013. The relationship between farm characteristics (floor type and space for bed) and farmers' profile (gender, age, full/part time involvement and

experience) was statistically analyzed using Crosstabs/ Fisher's exact test, and Correlation. One single question may not sufficient to distinguish the attitudes of dairy farmers. Hence, answers for each question were categorized into a particular group of attitude for the statistical comparison with farmer profile. Mean score of attitudes (Housing management (HA), Health management attitude (HeA), Feeding management Attitude (FA), and Calving management attitude (CA) were compared with farmers' profile using Ordinary Logistic Regression and Generalized Linear Model (GLM). The significance level was set at $P \leq 0.05$.

RESULTS AND DISCUSSION

Farmers' profile

In the present study, the majorities were small-scale milk producers (87.5%) with part-time involvement (72.5%) and thus, dairying was not the main source of income for most of smallholder dairy farmers in Kandy District, Sri Lanka. Men (77.5%) had higher contribution in dairy industry than female stockperson (22.5%) and age group of majorities were 35-50 years (42.5%) with more than ten years of experience (62.5%). Hired workers were not employed by the majority (95.2%) and run as a family obligation.

Farmers' attitudes toward dairy cows

Previous studies had shown the effect of role and impact of stockperson on animal was crucial on cattle welfare and productivity (Hemsworth, 2003). Human–animal interactions may markedly affect the productivity and welfare of farm animals. Attitude and behaviour of the stockperson are the key factors which determine the nature of human-animal interactions where negative attitudes towards animals resulted in poor human–animal interactions and could reduce animal welfare (Hemsworth and Coleman 2011). According to the current study, all most all dairy farmers had pleasant sensation on their dairy herd and had believed that the cows were emotional animal. However, from surveyed farmers, 57.5% felt that their herd was greedy towards them. Moreover, a considerable percentage of farmers in current study (40%) had responded that cows are smelly animals which is a negative attitude towards the cows leading to a negative human-animal relationship. Quality in human-animal interactions and good welfare is allied with productivity in the dairy industry (Ellingsen et al., 2014)

Farmer perception of cattle welfare

Animal welfare is recognized as an integral part of the responsible livestock sector as it is directly related to animal productivity and final product quality (Breuer et al., 2000). However, the current study showed that farmers were less aware (10%) of the concept of welfare of dairy cows. Among the farmers who had positive attitudes on welfare, 50% of them believed all five freedoms (Freedom from hunger, thirst and malnutrition, Freedom from discomfort, Freedom from pain, injury and diseases, Freedom to express normal behaviours, Freedom from fear and distress) were important for animal welfare. However, the rest of them (50%) believed that good health was the factor to determine animal welfare. Hence, farmers' awareness on this concept remains low. In present study, 87.5% of farmers were satisfied about the dairy industry. However, their level of satisfaction was varied. The majority (68.6%) exhibited medium satisfaction, and 5.8% exhibited less satisfaction. According to Lensink et al. (2001) job satisfaction has a strong impact on animal welfare and productivity. Hence, satisfaction on industry is essential to improve the welfare positive attitudes of farmers on dairy cows.

Drying-off procedure

Optimal periods of drying are essential to accommodate this transition period. During drying-off, behaviour and stress hormone levels of cows changed rapidly (Tucker *et al.*, 2009). Thus, better dry cow management practices are essential to maintain proper welfare conditions of dry cows. The best possible drying period is the subject of an ongoing controversial debate. A shortened dry period (35-40 days) had associated with reduced milk yield in the subsequent lactation (Watters *et al.*, 2008). In this study, average drying period was observed as 70 days and this period could be considered as better according to previous findings. All most all farmers had started the drying period when the gestation was seven months old (100%). Considering on welfare positive attitudes of farmers towards dry cow management practices, all most all the farmers (100%) had agreed that drying-off was important for the next lactation.

In the surveyed farms, gradual cessation of milking method was applied by 80% of farmers and others (20%) practiced abrupt cessation of milking. However, in Sri Lanka, there is no a fixed guideline to dry off cows. In India, the normal procedure to dry off a cow is to withdraw concentrate supplement two weeks prior to the start of the dry period and then milking is halted abruptly about 45 to 50 days before expected date of parturition (Singh, 2020). The actual drying procedures such as abruptly or gradually drying of cows by reducing the frequency of milking, differ between herds and countries. The reduction of milk production can also be achieved by feed restriction (Tucker *et al.*, 2009). Most of these feed changes involved reducing or removing concentrates, or reducing the quantity of the total mixed ration (TMR) being fed. However, none of the farmers in current study was practiced feed restriction for drying-off.

Housing management

During the drying-off period, better attention need to be given for nutritional management, hypocalcemia and calving (Fujiwara *et al.*, 2018). That would be relaxed with the use of quality indoor housing system during this period. In the current study, observed farm characters (floor type and space for bed) were not significantly affected by farmers' profile and that had specified, there was a distinctive concern of farmers on housing facilities. However, the attitude of farmers on housing management was in a proper condition because, majority concurred that dry cows need a suitable place to lie down, with enough space (96.6%) to perform normal behaviour (82.8%) and protect from bad weather (96.6%) as shown in Figure 1.

However, according to the results (Figure 1), considerably lower proportion of farmers were in agreement to provide a comfortable bed to rest (44.8%) and allowing free movements (27.6%). The interesting point is, half of the farmers were uncertain on allowing free movements to the cows. Hence, huge attention needs to focus to address those issues and to improve the awareness of farmers regarding housing

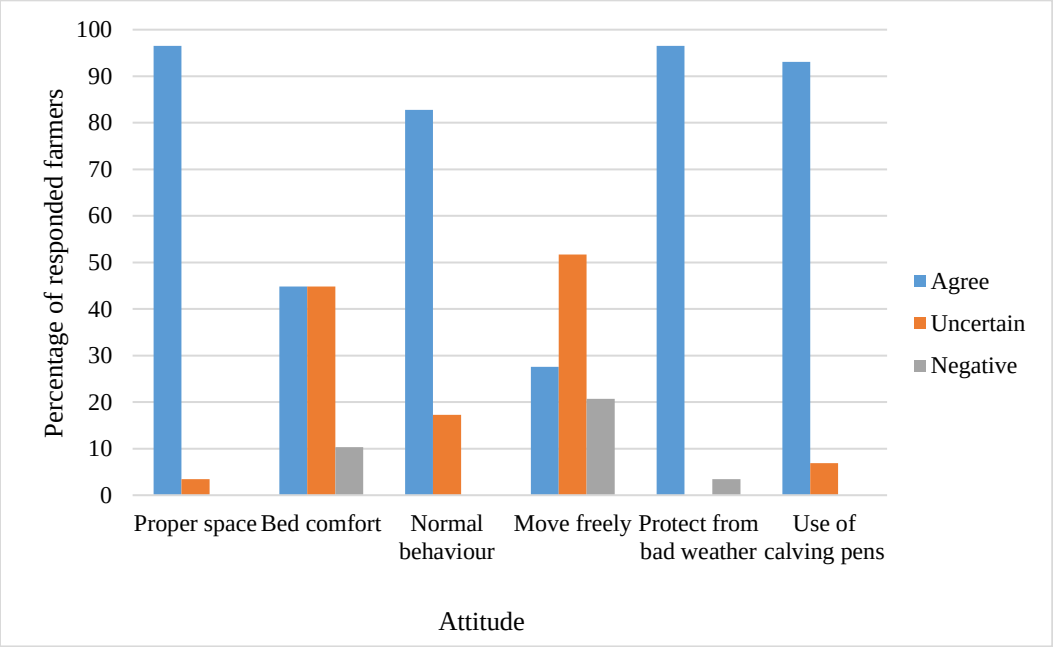

Figure 1: Variation of the percentage of responded farmers for welfare attitudes of housing management of dry cows

management practices. In current study, most of the cow barns (80%) had consisted of solid concrete floor and others with clay (20%). None was observed with a bedding material. Concrete is an abrasive surface with no compressibility, which has been allied with increased lameness in dairy cows (Vanegas *et al.*, 2014) and multiple studies have illustrated the benefits of softer flooring surfaces on dairy cow lameness (Haskell *et al.*, 2006). Keeping dry cows in straw pens is also a good measure to reduce the incidence of foot disorders (Rouha-Mülleder *et al.*, 2009). Furthermore, authors stated that the prevalence of lame cows was correlated with welfare positive attitudes of stockperson toward cows. Hoof caring and trimming is a best practice of welfare during dry off period (Fujiwara *et al.*, 2018). According to our observations, a significant percentage of farmers had never practiced hoof caring treatments (47.5%). Thus, it is essential to improve the awareness on hoof caring of dry cows.

Health management and handling

Concerning the health management of dry cows, most respondents had agreed that dry cows should have the right to be free from pain, injury and illness (95%), and must have immediate treatment (87.5%) in case of sickness (Figure 2). Results (Figure 2) had further illustrated, a considerable percentage of farmers who were uncertain on injuries (5.0%), immediate treatments (12.5%) and fear (17.5%).

The majority were attentive of diseases such as mastitis (72.5%), FMD (Foot-and-Mouth Disease) (82.5%) and a lower percentage of farmers with brucellosis (22.5%). Thus, a considerable group of farmers were not aware of common diseases. In Sri Lanka, a total of 4,454 mastitis cases during the third quarter of the year 2015 have been recorded

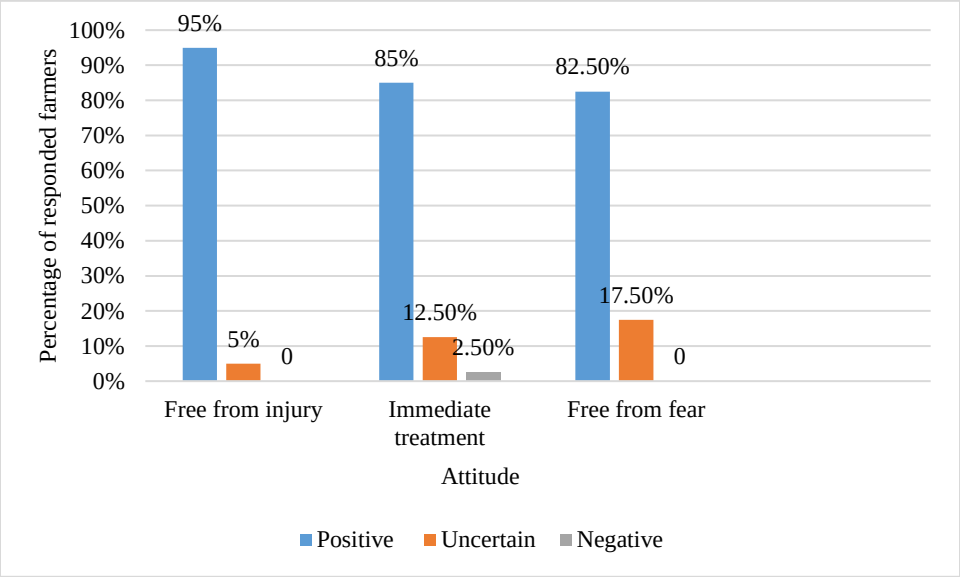

Figure 2: Variation of the percentage of responded farmers for welfare attitudes of health management of dry cows

in government veterinary offices. Among these, 396 cases have been recorded in Central Province (Kandy, Nuwara-Eliya and Mathale Districts) (DAPH, 2015) and a total of 89 clinically suspected Brucellosis cases also have been reported in Sri Lanka. During the same period of time, 109 FMD cases with 4 deaths have been reported and it was a rapid decline compared to the 3rd quarter of 2014 (12,673 cases with 307 deaths). According to that report proper vaccination programmes were the reason for it and thus, better awareness of farmers on the prevalence of these diseases would reduce the risk. Cows with subclinical mastitis during their dry-off period were at risk to infect other cows and increase the bulk milk Somatic Cell Count (SCC) in next lactation (Bhutto et al. 2012). Cows were most susceptible to clinical mastitis during early dry period, (Oliver and Mitchell, 1983) and therefore, sufficient monitoring of dry cows is important during this period. In the occurrence of disease, the majorities had isolated the diseased cow (87.5%) and endeavor to cure using traditional treatments before veterinary inspection (95%). Deworming the cows was practiced just below the half of the interviewed farmers (30%), and only 10% of respondents in the current study were concern about inspection of teats for possible mastitis in dry cows.

Farmers' attitudes regarding the handling process of dry cows was in better phase according to current observations. Majority had agreed that cows should have handled calmly (92.5%) and have a right to free from fear and unnecessary distress (82.5%).

Feeding management

Under the feeding management practices authors just focus to get an idea about the basic knowledge/attitude of farmers regarding feeding management practices on dry cows. According to the observations, majority of farmers had better concern on feeding management of dry cows. Majority had agreed about the rights of cows to be free from thirst (95%), hunger (95%), and they must have clean water (62.5%) and quality feed (82.5%) (Figure 3). This was a

satisfactory condition, however there were considerable percentage of farmers who did not concern on giving clean water to their dry cows (37.5%) and supplement of quality feed (17.5%). Moreover, some were uncertain about these factors (Availability of clean water- 37.5%, Free from thirst- 5.0%, Free from hunger – 5.0% and Availability of quality diet- 17.5%). Those will dramatically effect on the sense of animal welfare. Thus, these groups of farmers could be mentioned as crucial when concerning about the positive welfare attitude on feeding management practices.

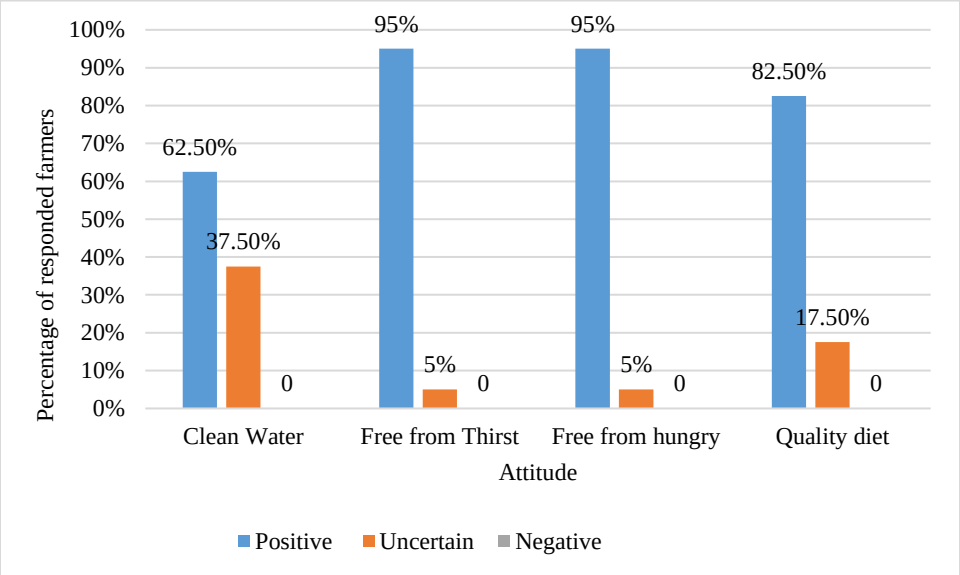

Figure 3: Variation of the percentage of responded farmers for welfare attitudes of feeding management of dry cows

Calving management

For better feeding and care, animals in the dry period should be separated from lactating animals. This practice will protect pregnant animals from injuries due to internal fighting and thus miscarriage, twisting, obstructed labor, and other complications. Importance of using calving pens for dry cows was identified as an essential management practice by the majority of farmers (95%) in current study. However, a previous research which was conducted based on Mid-Country (Kandy, Mathale and Nuwara Eliya districts) dairy farmers in Sri Lanka, none of them had used separate calving pens (Weerasinghe *et al.,* 2020). Hence, there was a gap of theoretical and practical awareness of farmers. Although they are concern about the consequence of using separate calving pens, sometimes they may not have enough facilities (financial, housing and etc.) to approach it.

In the present study, the calving process was regularly observed by majority of farmers (87.5%). This was further confirmed in a previous research (Weerasinghe *et al.,* 2020) conducted in Mid-Country (Kandy and Mathale districts) and Upcountry (Nuwara Eliya district) Sri Lanka and authors had reported cows were visited twice a day, once during the day and at night. The night visit was made for cows that were to give birth.

Welfare positive attitudes of calving management of farmers, were also considered as a vital routine practice in dry cow welfare. All most all farmers had agreed that calving is a painful process (100%), it is necessary to observe giving some help (87.5%) and it is essential to inform the veterinary surgeon in difficulty from birth (87.5%) (Figure 4). However, considerable percentage of farmers were uncertain on regular observation process (12.5%) and informing of veterinary surgeons (10.0%). These observations reflected awareness of farmers regarding better calving management practices.

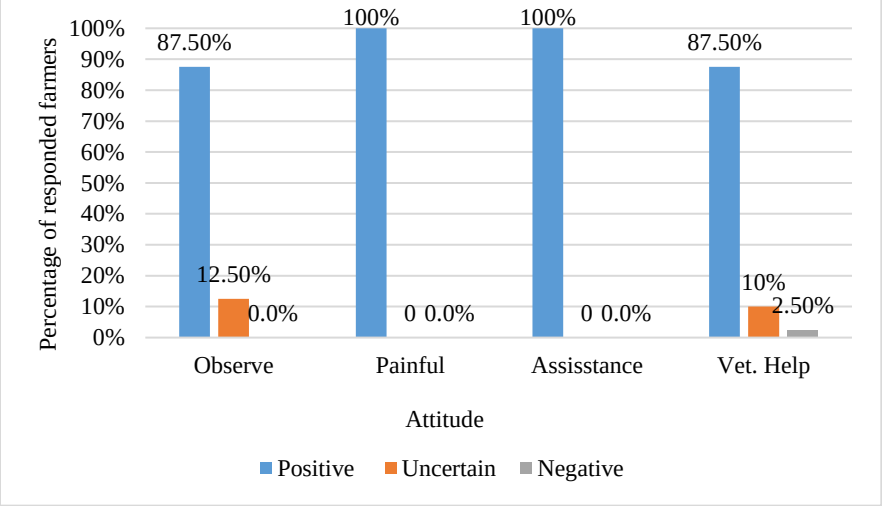

Figure 4: Variation of the percentage of responded farmers for welfare attitudes of calving management of dry cows

Overall attitude of farmer on dry cow welfare

The overall results of the current study revealed that majority of farmers have welfare positive attitudes about dry cow management practices. Variation of each attitude with the response is illustrated in Figure 5. Responses were categorized into three groups (Positive, Uncertain and Negative) based on the 5-point likert scale (1 and 2 – positive, 3 – Uncertain, 4 and 5 – negative).

According to the results (Figure 5) majorities were positive for each attitude (HeA – 85.8%, HA – 75.5%, FA – 81.8%, and CA – 93.8%). However, considerable percentages of farmers were uncertain on those attitudes (HeA – 10.8%, HA – 18.8%, FA – 15.0%, and CA – 5.6%) and answered: "Neither agree nor disagree". Only 5.8% of farmers had negative vision on attitudes. The interesting finding was percentage of farmers of negative attitudes were significantly lower than the percentage of farmers who were uncertain for welfare positive attitudes. Hence, it is vital to making sense on farmers about proper dry cow management practices.

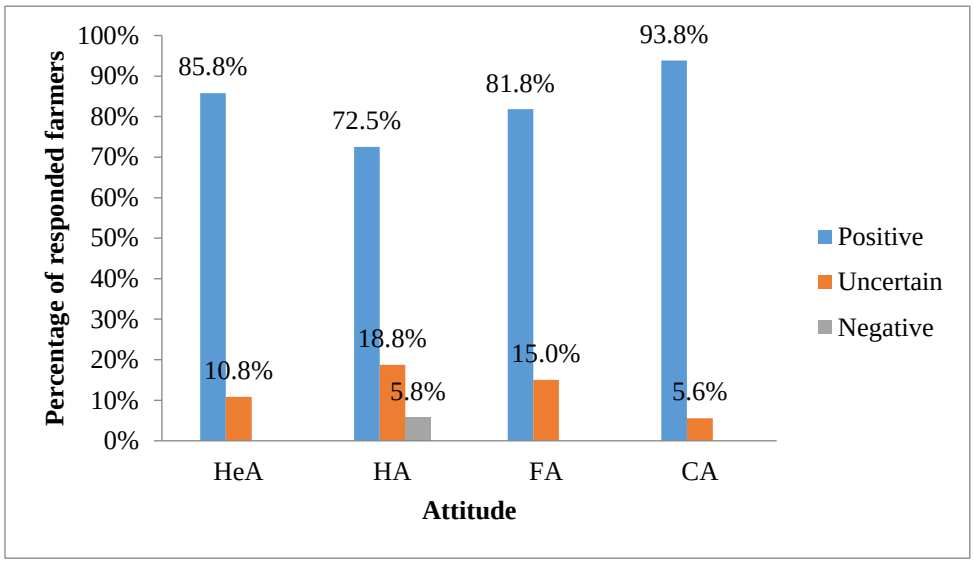

Figure 5: Variation of the percentage of responded farmers for welfare positive attitudes (HeA- Health management attitude, HA- Housing management attitude, FA- Feeding management attitude, CA- Calving management attitude)

Farmer behaviour on dairy cattle had affected on the welfare of cows (Kielland *et al.*, 2010). Results revealed that gender type was statistically significant with Health management attitude (HeA) (P = 0.033, odd log value = -3.072) and Calving attitude (CA) (P = 0.018, odd log value = -6.038). In GLM output exp (B) values were obtained as an odd ratio <1 (HA = 0.046 / CA = 0.002) and indicated a decreasing probability of HeA and CA with the gender. Hence, welfare positive attitude of health and calving managements (mean score of each attitude category) were increased with the decreasing of gender score (1 – Male, 2 - Female). This reflected that male farmers were exhibited better welfare positive attitudes at health and calving management of dry cows than female farmers. The female dairy farmers in Norway, did not score significantly higher in positive welfare attitudes and empathy measures (Kielland *et al.*, 2010). The authors had further described that the considerably lower number of participant of females (13%, 19 out of 149) might be the reason for a such kind of outcome. However, female farmers had a more positive welfare attitude with regard to the consequence of interactions with the calves (Lensink, Boissy and Veissier, 2000a). Hence, the relationship between gender and attitude may be varied with their background situation. In a previous experiment, females' attitude on veal calves were compared and had shown a more positive behaviour towards the calves (Lensink, Boissy and Veissier 2000a). In current study we focused on welfare of dry cows and some had based on attitudes and empathy towards dairy cows (Kielland *et al.*, 2010). Hence, these results could give only indications on the strength of associations between predictors and outcomes. Therefore, interpretations should be made with caution considering on farmer background.

The involvement (Full time/Part time) is also statistically significant with HeA (P = 0.013, odd log value = 3.262) and CA (P = 0.038, odd log value = 3.344). In both parameters, an odd ratio> 1 was observed and indicated

an increasing probability of HeA and CA (HeA = 26.098 and CA = 28.324) with the type of farmer involvement (1 – Full time and 2 – Part time). Therefore, welfare positive attitudes of health and calving managements were increased with the increasing of farmer involvement score. According to our scoring system, part-time involvement is positively affected with better treatment and calving attitudes. Farmers who work part-time have a job variance and treated cows amicably like pets. It will help them to reduce their stress at work. Welfare positive attitudes regarding health and calving management of dry cows were lower in full-time involved farmers. Among those full-timely involved farmers, majority were females (72.7%). Lower number of respondents of males might be the reason for poor concern of welfare positive attitudes of this group. Other possible reason maybe that females (full-time) had to work only one schedule throughout the day with their family obligations and this can result in fatigue, stress and dissatisfaction in the industry (Bertulat et al., 2015). Thus, better welfare positive attitudes were obtained for part-time farmers involved in dry cow management rather than full-time commitments. Being satisfied with the work and having positive beliefs about cows is a prerequisite for an open-minded relationship with the animals (Fukasawa *et al.,* 2017; Hemsworth, 2003).

Furthermore, welfare positive attitudes of farmers were not significantly affected by their age and experience by indicating that the attitudes were neither positive nor negative for welfare with his age or experience level. This was compatible with previous findings (Fujiwara *et al.,* 2018.; Spinka, 2014). Hence, seniority (youth, adult, senior) or experience level itself cannot improve welfare of dry cows and it was essential to refine farmers with proper knowledge. However, previous researches had reported, that farmer's own experience was the most common reason for choosing a particular approach (Scherpenzeel *et al.,* 2016). In a previous research conducted for dairy farmers in Mid-Country Sri Lanka, age group of farmer (youth:18-30, adult:31-65, senior: >65) had significantly contributed to welfare positive attitudes on calf management practices where youth group had more positive welfare attitudes (Weerasinghe *et al.,* 2020).

Personality and attitudes of farmers were significantly influenced on health, welfare, productivity and farm management of cows (Fujiwara *et al.,* 2018). Under the personal traits, characteristic patterns of thinking, feeling, and behaving were considered. Authors further reported that "agreeableness" was significantly negatively correlated with the percentage of farmers' neutral and negative behaviours toward cows. Efforts need to be made to support the farmer in reducing the negative attitudes and improving welfare status of dry cows. Specific attention given to dry cow management and their comfort in education, training, and specific campaigns seems important to changing farmers' attitude (Lam *et al.,* 2013). According to previous researches, simple fine liaison was not recommended in stockmanship and other professional and personal components, such as appropriate knowledge, technical skills, observational abilities and time availability are also considered (Lensink et al., 2001).

CONCLUSION

Even with a limited number of participants, the results of this survey provide information on the management practices and attitudes of cow welfare of farmers to identify potential sources of stress associated with the welfare of dry cows. Several dry cow management practices were identified as risk factors such as no higher satisfaction about the industry,

lack of concern about proper drying-off procedure, poor awareness on concept of animal welfare, hoof caring, inspection of teats for possible mastitis, and lack of periodical deworming. There is a requirement of improving attitudes for better dry cow rearing. Knowledge must be a priority and experts in the field must fill these knowledge gaps. Moreover, further acuity is required for the perceptions and awareness of farmers on welfare positive management practices of dry cows.

Conflict of interest:
We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Author contribution:
RMASB conceptualized the study. RGDPR conducted the survey. RMASB and WPCGW analysed the data. RGDPR and WPCGW prepared the draught manuscript. RMASB and TSS designed the study and reviewed the manuscript.

REFERENCES

Adler, F., Christley, R. and Campe, A. (2019) Invited review : Examining farmers' personalities and attitudes as possible risk factors for dairy cattle health, welfare, productivity, and farm management : A systematic scoping review. *Jounal of Dairy Science.*102: 1–20. Doi:10.1136/vr.104755

Bachman, K.C and Schairer, M.L (2003) Invited review: bovine studies on optimal lengths of dry periods. *Jounal of Dairy Science.*86: 3027–3037

Bertulat, S., Fischer-tenhagen, C. and Heuwieser, W. (2015) A survey of drying-off practices on commercial dairy farms in northern Germany and a comparison to science-based recommendations. *Veterinary Record.* 2: 1–10. Doi:10.1136/vetreco-2014-000068

Bhutto, A.L., Murray, R.D. and Woldehiwet, Z. (2012) California mastitis test scores as indicators of subclinical intra-mammary infections at the end of lactation in dairy cows. *Research in Veterinary Science.* 92: 13–17.

Breuer, K., Hemsworth, P.H. and Barnett, J.L. (2000) Behavioural response to humans and the productivity of commercial dairy cows. *Applied Animal. Behavioral Science.* 66: 273–288

Cummins, C.D., Berry, D.P., Sayers, R., Lorenz, I. and Kennedy, E. (2016) Questionnaire identifying management practices surrounding calving on spring-calving dairy farms and their associations with herd size and herd expansion. *Animal*. 10(5): 868–877. Doi:10.1017/S1751731116000124

DAPH, Annual Report 2015 Department of animal production and health. Viewed 02/08/2021.http://www.daph.gov.lk/web/images/content_image/publications/annual_reports/ar_2015_new.pdf

Ellingsen, K., Coleman, G.J., Lund, V. and Mejdell, C.M. (2014) Using qualitative behaviour assessment to explore the link between stockperson behaviour and dairy calf behaviour. *Applied Animal Behavioral Science.* 153: 10–17. Doi:10.1016/j.applanim.2014.01.011

Fujiwara, M., Haskell, M.J., Macrae, A. and Rutherford, K.D.M. (2018) Survey of dry cow management on UK commercial dairy farms. *Veterinary Record* 1–8. Doi:10.1136/vr.104755

Fukasawa, M., Kawahata, M., Higashiyama, Y. and Komatsu, T. (2017) Relationship between the stockperson's attitudes and dairy productivity in Japan. *Animal Science Journal,* 88:394–400.

Haskell, M.J., Rennie, L.J., Bowell, V.A., Bell, M.J. and Lawrence, A.B. (2006) Housing System, Milk Production and Zero-Grazing Effects on Lameness and Leg Injury in Dairy Cows. *Journal of Dairy Science.* 89(11): 4259–4266. Doi:10.3168/jds.S0022-0302(06)72472-9

Hemsworth, P.H. (2003) Human - Animal interactions in livestock production. *Applied Animal Behaviour Science.* 81: 185-198. Doi:10.1016/S0168-1591(02)00280-0

Hemsworth, P.H. and Coleman. J.G. (2011). Human Livestock interactions : the stockperson and the productivity and welfare of intensively farmed animals (2nd ed). CABI Head Office, Nosworthy Way, Wallingford, Oxfordshire OX10 8DE, UK

Kielland, C., Skjerve, E., Østerås, O. and Zanella, A.J. (2010) Dairy farmer attitudes and empathy toward animals are associated with animal welfare indicators. *Journal of Dairy Science.* 93(7): 2998–3006. Doi:10.3168/jds.2009-2899

Lam, T.J.G.M., Van den Borne, B.H.P., Huijps, J.K. and Van Veersen, J.C (2013) Improving bovine udder health: A national mastitis control program in the Netherlands. *Journal of Dairy Science.* 96:1301–1311.

Lensink, B.J., Boissy, A. and Veissier, I. (2000) The relationship between farmers' attitude and behaviour towards calves, and productivity of a veal units. *Annales Zootechnie*, 49: 313-327. Doi:10.1051/ animres:2000122

Lensink, B.J., Veissier, I. and Florand, L. (2001) The farmer's influence on calves' behaviour, health and production of a veal unit. *Animal Science Journal.* 72: 105-116.Doi:10.1017/S1357729800055600

Mills, K.E., Von Keyserlingk, M.A.G. (2020) Identifying barriers to successful dairy cow transition management. *Journal of Dairy Science.* 103 (2): 1749–1758. Doi:10.3168/jds.2018-16231

Mulligan, F.J. and Doherty, M.L. (2008) Production diseases of the transition cow. *Veterinary Journal.* 176:3–9.

Oliver, S.P. and Mitchell, B.A. (1983) Susceptibility of bovine mammary gland to infections during the dry period. *Journal of Dairy Science.* 66: 1162–1166

Pinedo, P., Risco, C. and Melendez, P. (2011) A retrospective study on the association between different lengths of the dry period and subclinical mastitis, milk yield, reproductive performance, and culling in Chilean dairy cows. *Journal of Dairy Science.* 94: 106–115

Rouha-Mülleder, C., Iben, C., Wagner, E., et al. (2009) Relative importance of factors influencing the prevalence of lameness in Austrian cubicle loose-housed dairy cows. *Preventive Veterinary Medicine.*, 92:123-133

Scherpenzeel, C.G.M., Tijs, S.H.W., Den Uijl, I.E.M. and Velthuis, A.G.J. (2016) Farmers' attitude toward the introduction of selective dry cow therapy. *Journal of Dairy Science.* 99(10): 8259–8266. Doi:10.3168/jds.2016-11349

Singh, R. (2020) Management tips for Dry Cow Therapy & Guidelines for drying off pregnant cows. https://www. pashudhanpraharee.com/management-tips-

for-dry-cow-therapy-guidelines-for-drying-off-pregnant-cows.

Spinka, M. (2014) Associations of stockpersons' personalities and attitudes with performance of dairy cattle herds. *Czech Journal of Animal Science.* 50(5): 226–234. Doi:10.17221/4162-CJAS

Tucker, C.B., Lacy-Hulbert, S.J. and Webster, J.R (2009) Effect of milking frequency and feeding level before and after dry off on dairy cattle behavior and udder characteristics. *Journal of Dairy Science.* 92: 3194–3203

Vanegas, Overton, M., Berry, S.L and Sischo, W.M. (2014) Effect of Rubber Flooring on Claw Health in Lactating Dairy Cows Housed in Free- Effect of Rubber Flooring on Claw Health in Lactating Dairy Cows Housed in Free-Stall Barns. *Journal of Dairy Science.* 89: 4251–4258

Watters, R.D., Guenther, J.N., Brickner, A.E., et al. (2008) Effects of dry period length on milk production and health of dairy cattle. *Journal of Dairy Science*. 91: 2595–2603. Doi:10.1016/j.prevetmed.2013.05.015

Weerasinghe, W.P.C.G., Rajapaksha, E., Gunawardena, W.W.D.A. and Samarakone, T.S. (2020) Relationship between management practices and calf welfare in mid- country dairy farms in Sri Lanka. *Tropical Agriculture Research.* 31(1): 103. Doi:10.4038/tar. v31i1.8347