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Risk Factors and Indicators of Reduced Welfare of Grazing Dairy Cows from Selected Smallholder Dairy Farms in Midlands Province

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Abstract

Zimbabwe´s smallholder dairying faces many challenges that affect the welfare of dairy cows; however the status of this welfare has not yet been determined. A cross sectional study was conducted in Midlands Province on 41 active smallholder dairy farms with 86 cows in winter and summer, to determine the risk factors and indicators to impaired cow welfare. These objectives were achieved using farmer questionnaires and direct observations. 11% of the observed cows were severely lame in summer while only five % were severely lame in winter. Lameness was significantly associated with season, absence of shade, breed and low dipping frequency; 58% of the cows had low body condition scores (BC<3) and this low BC was associated with low frequency of protein (p=0.002) and vitamin (p=0.012) supplementation recorded in more than 52% of the farms visited. In winter only 11% of the observed cows were heavily soiled (score 3), whilst in summer 64% of the cows were heavily soiled and this was associated with slurry accumulation in more than 80% of the observed cattle pens as well as the study season (p<0.001). A quarter (26%) of the studied animals had visible teat lesions on the teat skin and this was associated with type of lubricant used (p =0.011). Only 34% of the cows allowed an approaching stockman to touch them and this was associated with shouting (p=0.012) and whipping of cows (p=0.002). The study concluded that welfare of dairy cows was poor in most of the smallholder dairy farms studied.

Keywords: Risk factors; Indicators; Cow welfare

Introduction

Consumers of animal products in the whole world have become increasingly concerned about food quality, safety and welfare of farm animals. As a result, new approaches, new regulations and new standards have been developed to ensure particular animal welfare levels on farm. Zimbabwe like many African countries is lagging behind and has its Prevention of cruelty to animals act of 1960, which doesn't effectively address modern day animal welfare realities. On the other hand, rangeland (veld) in Zimbabwe is of good quality only in wet summer (November-February) whereas in winter veld quality drastically drops. Five percent of the smallholder dairy farmers in Zimbabwe own forage pastures while about 10% supplement their cows with urea treated stover and sometimes maize silage in winter. The grazing area is shared by the community with a recommended carrying capacity of 1LU/ 9 hectares and a stocking rate of 1LU/3 hectares.

This high stocking rate has resulted in overgrazing and consequently increased erosion and grass stunting in most Zimbabwean rangelands. Knap sac spraying is used for tick control of the dairy herd; vaccination for Foot and Mouth disease as well as rabies is done by the Government, while vaccination and control of other prevalent diseases like Lumpy Skin Disease, black leg and brucellosis is done by farmers. Studies done in Kenya on the welfare of zero grazing dairy cows showed that poor welfare of dairy cows existed in smallholder dairies [1].

Zimbabwe's smallholder dairy is also characterized by challenges such as high prices of protein rich commercial concentrates which results in inadequate and inconsistent protein supplementation to dairy cows; frequent outbreaks of diseases [2]; poor husbandry practices and lack of high yielding exotic breeds. These challenges to smallholder dairy systems, results in lowered body condition, which then impacts negatively on cow health, productivity and consequently welfare of the cow. Welfare of grazing cows in both the small holder set up and large-scale dairies in Zimbabwe and Africa as a whole has not been adequately studied and with the growing concern on food quality and safety from consumers, there is compelling need to evaluate welfare of cows in these sectors. Improved cow welfare will not only improve productivity of the dairy cow but the whole milk supply chain will benefit, hence the importance and relevance of this study.

Materials and Methods

The research was conducted in two selected districts of Midlands Province (Gweru and Gokwe South) targeting active smallholder dairy farmers. Midlands is characterized by cold-dry winters (5 to12 °C, 0 to 20mm) and hot humid summers (25 °C to 30 °C, 500mm to 700mm). Mature dairy cows (Red Dane, Jersey, and Holstein mainly crossed with either Tuli or Mashona) from each selected household were examined for the study regardless of their lactation status. In those smallholder units that had less than 5 cows; all cows were used for the study whilst in those units that had more than 5 cows, simple random sampling was used to select 5 cows to be used for the study. Each household was then visited once in winter i.e. from 3 August 2015 to 29 September 2015; and once in summer i.e. from 23 December 2016 to 17 February 2017 to determine the indicators and risk factors to reduced cow welfare using a questionnaire administered through face to face interviews and an animal as well as farm observation tool. All the farmers in Midlands Province who were actively supplying milk to the milk collection center or producing milk for sale (organized smallholder dairies) were included in the study i.e. 35 households from Gokwe South (70 cows) and 6 households from Gweru (16 cows).

Questionnaire

Data collected using the questionnaire included: Household (HH) demographics; level of education for HH; agriculture training received by HH; number of people staying at the HH; dairy herd demographics; institutional support; number, structure and breeds; general husbandry and milking practices; dehorning, castration, hair tail; euthanization methods; udder hygiene; teat lubricants; feeding and watering of animals; energy, protein, vitamin and mineral supplementation frequency; source and distance of water source.

Animal observation tool

Lameness- measured when the cow was either going in or out of the milking parlour using the lameness score sheet during both winter and summer. Lameness was measured on a 4 point scale of 0-3 with 0 indicating good mobility and 3 the animal will be severely lame [3].

Cow cleanliness

This was assessed in winter and summer on similar cows by the investigator early in the morning before cows were released for grazing using a cow cleanliness score chart

Body condition

Scored by the investigator on a scale of one to five during feeding times using a body condition score chart during both summer and winter and on similar cows

Hair loss

Recorded in both winter and summer on a scale of one – three using the hair loss score chart

Teat and hind limb lesions

Teat lesions scored in both winter and in summer as either present or absent

Skin and hind limb lesions

Scored as either present or absent. Skin lesions scored once in winter as either present or absent.

Aggressive interactions between cows

Coded as either frequent or not frequent and were observed during feeding times in winter only for at least 10 minutes per each smallholder unit visited

Avoidance distance

Each cow was assessed once in winter during the study period. Avoidance distance was categorized into cows that could be touched, cows that could be approached 50cm but not touched, cows that could be approached as closely as 50 -100cm, and cows that could not approached as closely as 100cm [4].

Farm observation tool

Site and material used for kraal construction; state of kraal floors, presence of shade, foot bath and handling facilities

Data analysis and presentation

Data was entered and cleaned in Microsoft Excel and then exported into IBM Statistics SPSS version 23. Basic descriptive statistics were generated followed by tests association (chi square tests of independence) between risk factors and indicators of reduced cow welfare.

Results and Discussion

A total of 36 households owning 86 cattle were interviewed from Gweru and Gokwe South districts of Midlands Province, Zimbabwe.

Lameness

In the dairy sector, lameness is considered an endemic disease that affects health and welfare of dairy cattle and results in production loss [5]. Figure 1 shows percentage lameness scores by season while Table 1 shows factors significantly associated with lameness. Study results revealed that more cattle were lame in summer than in winter. The overall low proportion of lame cows in the study (5% winter and 11% summer) may be attributable to the disease resistant cross breeds that dominate the smallholder dairy sector in Zimbabwe and the fact that the studied cows were not

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confined but had free access to pasture giving them adequate opportunity to exercise thereby improving claw conformation [6].

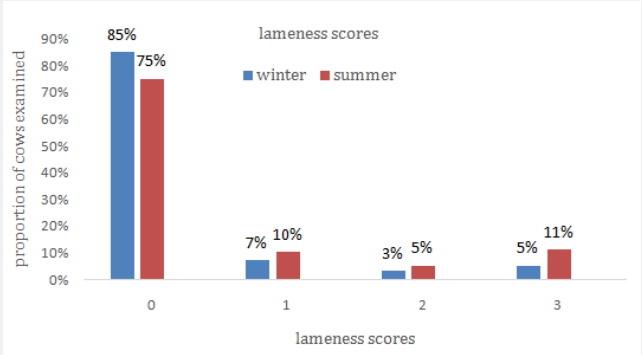

Figure 1: Lameness scores (0, 1, 2, and 3) by season for smallholder dairy cows, Midlands Province, Zimbabwe.

Table1: Factors associated with lameness in smallholder dairy cattle of Midlands Province, Zimbabwe.

Chi square	DF	P	
Absence of shade structures	14.6004	1	P<0.001
Low dipping frequency	7.2999	1	P=0.007
Breed of the cow	16.124	6	P=0.013
Season	13.203	1	P<0.001

These findings were in concordance with the work of other authors [7], who reported herd lameness for grazing cows to be 3.5% in Ethiopia. The association between lameness and absence of shade (p<0.001) on most dairy farms may be attributable to the fact that the presence of shade enhances passive ventilation and lowers body temperature and thus reduce restless behavior, and increases the time spent resting by cows thereby reducing the chances of lamenes. The association between moderate lameness cases and low dipping frequency has not yet been reported and may be attributed to ineffective tick control that promotes the spread of ticks in cattle and dip resistance to ticks. Bond legged ticks were noticed between the claws in some of the lame cows and this resulted in poor gait in some of the infested dairy cows. Holstein crosses had higher locomotion score compared to their counterparts (Red Dane* Tuli crosses and the Jersey crosses). The Red Dane* Tuli cross showed higher lameness resistance compared to the other two breeds and had low locomotion scores; this has been previously recorded [8].

The observation that slurry and cattle manure was not removed from cattle housing on a regular basis in 73% of the observed farms, implies that animal welfare is poor among most smallholder dairy farms. The association between lameness and season was expected and is in concordance with the work by other authors [9]. Most kraals were wet and muddy in summer. Moisture and slurry softens and damages the claw resulting in lameness. The observed foot lameness scores of three were in most cases, a result of direct trauma to the foot most likely by sharp objects like rough edges of toughs and stone bruises (Table 1). There was no significant association between levels of education of the household head as well institutional support farmers received and occurrence of lame cows in studied households (Figure 1).

Cow cleanliness Study results revealed that there were more heavily soiled cows (score 3) during the rain summer season (P<0.001) compared to the dry winter season (Figure 2). Significant association tests were conducted between cow cleanliness and the following factors: Lameness, body condition score, and slurry accumulation in cattle kraals and season. Percentage cleanliness scores of smallholder dairy cows by season, Midlands Province, Zimbabwe.

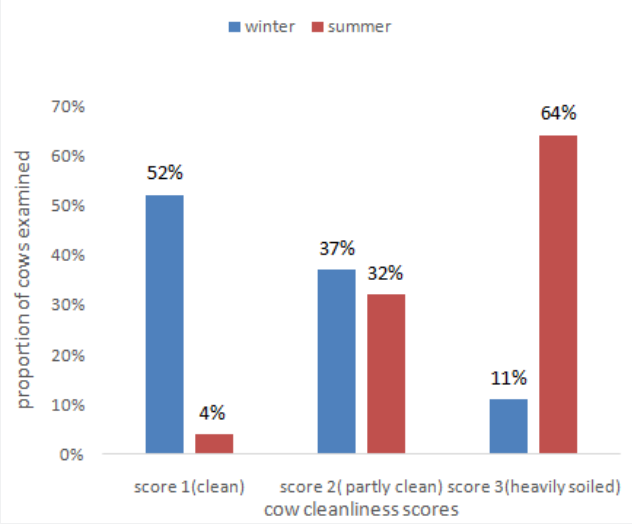

Figure 2: Percentage cleanliness scores of smallholder dairy cows by season, Midlands Province, Zimbabwe.

Cow cleanliness was significantly associated with manure accumulation in cattle kraals ($\chi 2$= 33,218, df=1, p<0.001) and season ($\chi 2$ =14,234,104, df=1, p<0.001). The good husbandry practice of removing manure and slurry was not done on a regular basis i.e. once per week, by the majority of farmers (80%) which led to the accumulation of manure and slurry in most kraals. Failure by smallholder dairy farmers to remove slurry on a regular basis may predispose cows to environmental mastitis [10]. The claw lesions will result in lameness and consequently impaired cow welfare. Instead of regularly removing slurry from cattle pens famers opted to let the dung accumulate as manure which is then used to

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fertilize crops at the expense of cow comfort. On those farms that were visited when cows were still in their kraals, dairy cows were observed lying on top of manure, fresh cow dung and sometimes on bare earth.

Body condition Figure 3 illustrates the percentage distribution of various body condition scores from the two study sites by season and Table 2 shows factors significantly associated with good body condition. Cattle condition picked up in summer and severely dropped in winter. The observation that in most of the farms (52%), protein concentrates were not given on a regular basis (Table 2) implies that feeding standards for most of these smallholder units was below the expected average. The association significance observed in this study between a good body condition score and regular feeding of commercial concentrate shows the welfare benefits of including standard levels of protein and energy in diet of dairy cows. Cows in poor body condition have low levels of milk fat and low overall milk yields because of inadequate reserves of protein and energy and may undergo anoestrus up and until the body condition improve [8]. Verbal information from farmers showed that protein concentrates were fed to lactating cows only, an indication that dry cows and heifers were denied access to quality nutrients in these production units. There was no significant association between regular feeding of home mixed concentrates (sunflower cake and crushed maize) and a good body condition. However, though not verified, it could be due to a poor mixing ratio of sunflower and crushed maize as well as failure to quantify properly these supplements when offering them to cows. The observation that farmers who had received formal agriculture training (25%) owned the majority of cattle with an optimum body condition demonstrates the benefits of formal agriculture training in improving cattle welfare and hence productivity. However, no association significance was observed between institutional support received by farmers and observed body condition scores.

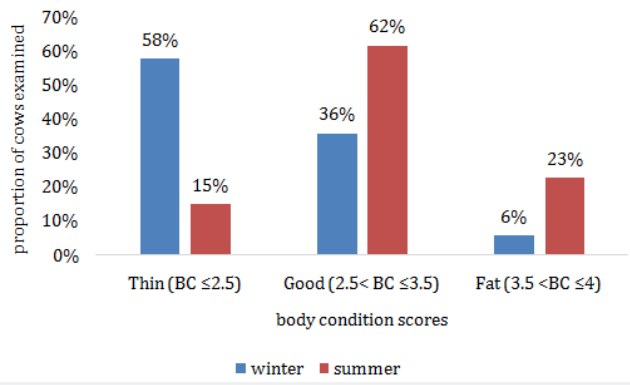

Figure 3: Body condition (BC) scores as a percentage of the total number of studied smallholder dairy cows, Midlands Province, Zimbabwe.

Table 2: Factors associated with body condition, small-scale dairy, Midlands Province, Zimbabwe.

season		19.434	1	P<0.001
Level of education		8.75	2	P=0.003
Protein concentrates	48	9.226	1	P=0.002
Vitamin/mineral	32	17.658	1	P<0.001

Air loss

As shown in Table 3, very few cows (3%) had large patches of hair loss. These observed hair loss scores were in most cases a direct result of prior exposure to skin diseases.

Table 3: Hair loss scores in cows from small-scale farms in Midlands Province, Zimbabwe.

Hair Loss Score	% of cows
0	66%
1	31%
2	3%

Skin lesions and their implications

These were confined to various body parts like the neck, abdomen, tail head and ribcage. The observed skin lesions reflected poor management and indicated that dairy cows in these smallholder farms were living in harmful environments. Among the 41 farms visited 32% of the observed animal houses had sharp protruding poles and wires on either the entrance or on the side walls. These wires and protruding poles were possible causes of abdomen and rib cage lesions and were statistically tested but had no significant effect. Use of opened up metal drums with rough edges in 26% of the studied farms was put forward as a risk factor to observed neck and mouth lesions but no significant association was found. The unexpected lack of significant association between rib cage lesions and presence of sharp protruding poles in cattle houses, as well as lack of significant association between neck lesions and use of metal drums with rough and sharp edges could be due to the small sample size and other factors which could not be assessed on the farm like thorns from the grazing area which could prick cows as well as use of barbed wire in paddocks. Verbal information from farmers also revealed that some of the observed skin lesions were caused by surgical removal of warts using hot knives and removal of horns in adult cattle although this was not very common. The verbal discussions also revealed that anesthetics were not being used by many farmers.

Hind limb lesions from the 86 animals observed, 36% had lesions on hind limbs. Hind limb lesions were significantly associated ($\chi 2 = 6{,}567$, $p=0.010$) with tying of hind limbs during milking. The practice of tying hind limbs while milking was being practiced on 82% of the farms visited.

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Teat lesions from the 86 cows assessed, 26 % had visible teat lesions such as scratches, swellings and cracks on the teat skin. For effective mastitis control and improved dairy cow welfare, there is need to maintain good teat skin through use of teat lubricants and proper milking procedures [11]. Table 4 shows proportion of farmers that used various teat lubricants.

Table 4: Teat lubrication methods used by smallholder dairy farmers in Midlands Province, Zimbabwe.

Teat Lubrication Method	Percentage of Farmers
Milk salve	34%
Petroleum jelly	24%
No lubricant	42%

Occurrence of teat lesions was significantly associated with the type of teat lubricant used ($\chi2$=12.982, df= 4, p =0.011). This was anticipated because teat lubricants reduce friction between the teat and the milker's hands when hand milks and act as insulators to teats thereby reducing chances of teat damage. The use of milk salve was more common in Gokwe South where famers were getting the lubricant from the Milk Collection Centre (MCC) and Non-Governmental Organizations (NGOs) than in Gweru where no such assistance existed. In Gweru there was use of petroleum jelly as a substitute for milk-salve which was not locally available. The observation that there were fewer cows that had teat lesions belonging to farmers who were using petroleum jelly when compared to those farmers that did not use any teat lubricant, confirms the welfare benefits of teat lubrication to dairy cows. In Zimbabwe petroleum jelly is cheap and locally available lubricant used by people. When used as a lubricant by human beings, petroleum jelly protects: minor cuts, skin scraps, dry and cracked skin by preventing moisture loss from these areas thereby speeding up the natural healing process. These are the same roles that are played by milk salve on cattle teats, making petroleum jelly an effective substitute for milk salve. Factors that were not investigated such as teat pulling could also be held accountable for the unexpected occurrence of teat lesions even on those farms where teat lubricants were frequently used. However, the practice of allowing calves to suckle before and after milking reported in more than 10% of the farms visited, could also be attributable to some of the teat lesions observed in cows belonging to farmers who were using teat lubricant.

Aggressive interactions

Frequent aggressive interactions between cows were recorded in 31% of the 41 farms studied and were significantly associated with an inadequacy of feeding space ($\chi2$= 20.757, df=1 p<0.001). When feeding simultaneously and if feeding space is inadequate cows compete and, in the process, shy and weak cows are bullied away. Aggressive interactions between cows were more common in instances where cows were sharing a single small feeding trough. When cows were feeding simultaneously, feeding space per cow was not adequate (<0.5m per cow) in 72% of the observed farms. On some farms three to four cows were observed sharing feed from an opened up tire or a small wooden feeding trough. In those situations, cows were then observed pushing against each other and the shy feeders moving away from the trough.

Avoidance distance

Only 34% of the cows studied were touched by the approaching stockperson, the rest moved away. The association between avoidance distance and use of whips as well as shouting at cows (Table 5) was attributable to the fact that dairy cows can remember negative interactions and the place where these negative interactions may have occurred as well as the negative handler. Negative interactions such as use of whips, shouting and whistling when handling cows, results in poor growth performance and lowers immune response in dairy cows [12]. The association significance between avoidance distance and frequency of mineral supplementation to dairy cows could be related to regular feeding of nutritious feed to cows which improves the quality of human to cow relationship as the cows get used to and enjoy contact with the stockman who feeds them with quality feed. There was no association between avoidance distance and factors such as institutional support and farmer level of education.

Table 5: Factors associated with avoidance distance, smallholder dairy, Midlands Province, Zimbabwe.

$\chi2$	df	P	
Use of whips	9.664	1	0.002
Shouting at cows	6.286	1	0.012
Regular giving of minerals	4.108	1	0.043
Regular giving of commercial concentrate	7.149	1	0.009

Conclusion and Recommendations

Poor dairy cattle welfare exists in the smallholder dairy production systems in Zimbabwe. Zimbabwe Agriculture extension departments should promote pasture and forage production among smallholder dairies and should also incorporate lessons on animal welfare in its curriculum. Zimbabwe should enforce implementation of the Prevention of cruelty to animals act of 1960 and where possible come up with a more comprehensive Animal welfare act. To raise childhood awareness on animal welfare issues, it is further recommended that Primary schools education curriculum should include animal welfare lessons and there is need for innovation platforms on animal welfare in Zimbabwe. Further studies can be done to evaluate dairy calf welfare to evaluate the potential of the replacement dairy herd.

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