Welfare of dairy cattle in the smallholder (zero-grazing) production systems in Nairobi and its environs

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Abstract

Animal welfare is defined as the ability of an animal to interact comfortably with its environment through its physiological, psychological and behavioural systems. About 70% of dairy production in Kenya is from the smallholder production systems. These production systems are negatively impacted by a number of factors including poor nutrition, substandard husbandry and management practices, lack of appropriate farm inputs, diseases and low incomes. These factors influence the welfare of dairy cattle, hence their importance for its evaluation. This study was therefore designed with the following objectives: 1. to determine the welfare of dairy cattle in the smallholder production units in Nairobi and its environs, 2. to determine the risk factors contributing to poor welfare of dairy cattle in the smallholder production units, 3. to determine the indicators of poor welfare of dairy cattle in the smallholder production units, 4. to determine the farmers' and stockmen's perspectives of animal welfare. These objectives were achieved through a cross-sectional study carried out in 80 smallholder dairy units purposively selected in Nairobi and its environs, in which 306 dairy cows were examined. The welfare of cattle in these dairy units was evaluated through several methods which included: visual observations for animal- and farm-level factors that indicate poor welfare of cattle; taking measurements of dairy housing unit dimensions such as cubicle, walk-alley, kerb and feeding bunk; and using a structured questionnaire to interview farmers and stockmen on nutritional regimes and other management practices such as removal of slurry, milking techniques, record keeping and disease control. These factors were recorded and later analyzed. Analyses included descriptive statistics, and simple associations using chi-square at $p< 0.05$ significance level.

Over 80% of these smallholder units had factors that contributed to poor welfare of dairy cattle. These factors included under-size cubicles, small walk-alleys, too high feeding bunks with traumatic edges, too low positioning of neck rails at the feed bunks, sharp objects and edges within the housing units and dilapidated housing structures. The main evidence of poor welfare was injuries on the animals. The body condition score (BCS) of the cows was the main indicator of welfare relating to feeding. Presence of injuries or scars on the skin at various parts of the body was considered a positive indicator of poor welfare either associated with housing structures, management practices or animal interactions. Other causes of poor welfare of the cows were hind-limb tying during milking, teat pulling during hand-milking, more than 24-hour delay before sick cows were treated, and mixing of cattle of different age-groups in the same compartment. Cow-human interaction was poor as evidenced by fearful response and long avoidance distance.

This study concludes that poor welfare of dairy cattle exists in all the smallholder units evaluated, which is mainly caused by improper housing and management. Training of farmers and stockmen on animal welfare issues would therefore be a prerequisite to the improvement of dairy cattle welfare. Research on the physiological response to poor welfare of dairy cows in the smallholder units needs to be carried out to enhance the understanding of the impact of these risk factors on smallholder dairy animals.

Keywords: feeding practices, farm-factors, management practices, poor welfare

Introduction

There are about 1.8 million smallholder dairy production units in Kenya contributing over 70% of all the marketed milk (Wakhungu 2001; Owen et al 2005; Muriuki et al 2003; SDP 2005). The production performance of the smallholder dairy units in Kenya and other tropical countries with similar environmental pressures is generally low, averaging daily milk yield of 7.5 litres per cow (Owen et al 2005; MOLFD 2006; Musalia et al 2007). This sub-optimal production is attributed to a number of constraints such as poor nutrition, substandard animal husbandry, lack of proper dairy farming facilities and prevalence of some diseases (Gitau et al 1994; Mutugi 2004; Owen et al 2005). Furthermore, the low income of small-scale farmers causes significant financial constraints that impact negatively on their smallholder enterprises and affects their livelihood (SDP 2005). Intensification of smallholder dairy production in an endeavour to maximize profits has led to deteriorating husbandry standards with subsequent stressful conditions that affect the welfare of dairy cattle in these smallholder units. Poor welfare conditions have direct negative effects on physiology, behaviour, disease susceptibility and productivity of an animal (Broom 2001; OIE 2005).

A number of diseases are related to poor welfare of dairy cattle. These include: lameness, mastitis and poor reproductive performance (Gaworski et al 2003). In Kenya, previous studies have shown that lameness (Gitau et al 1996; Nguhiu-Mwangi et al 2008), mastitis (Omore 1997; Abuom 2006) and poor reproductive performance (Odima 1993) are prevalent in the smallholder dairy production systems. The dairy products in Kenya are produced in both small-scale and large-scale farming systems with varying animal welfare practices. The welfare of dairy cattle and the risk factors causing poor welfare of dairy cattle in Kenya have not previously been determined, hence the relevance and need for the current study.

Materials and Methods

Geographical study area

This was a cross-sectional study carried out in peri-urban areas of Nairobi, Kenya between July and October 2009. These peri-urban areas included parts of Kiambu, Kikuyu and Kajiado districts. Nairobi is the capital city of Kenya and occupies an area of approximately 696 square kilometers. It lies between 01° 17´S latitude and 36° 48´E longitude. Nairobi has an estimated population density of over 3017 persons per square kilometer. It has a high number of smallholder dairy production units owing to availability of a ready market for milk in the city. The peri-urban areas included in the study were located North, South and West of the City. The study area was divided into 4 zones, which were designated as North, South, West and Central. Nairobi suburbs were designated as the Central zone. Each zone was further subdivided into 4 subzones.

Study design and selection of the smallholder units

This was a cross-sectional study in which each smallholder (zero-grazing) unit was visited once during the whole period of data collection. A total of 80 smallholder dairy units were included in the study. In this study, a smallholder dairy unit was defined as one with a minimum of 3 and a maximum of 16 adult dairy cows. From each zone, 20 smallholder units (5 from each of the 4 subzones) were purposively selected through the help of local Veterinarians and Animal Health Assistants with whom the smallholder farmers were more acquainted. The purposive selection method was chosen due to logistical reasons based on farmers' willingness to co-operate and allow their dairy units to be used in the study.

Animal selection in each smallholder unit

The animals included for examination were adult dairy cows, whether in milk or dry. In any smallholder unit that had 5 or less cows, all were selected for examination. In those smallholder units that had more than 5 cows, only 5 were selected for examination. The five were selected using a simple systematic sampling method. In each of such smallholder units, cows that met the selection criteria were isolated from the rest and serially numbered as 1, 2, 3, to s, where s was the last serial number depending on the total number of cows isolated in that unit. To avoid biased sampling, the serial numbering of the isolated cows was done by a farm worker. Then from the serially numbered cows, every second cow in the series was systematically selected by the investigator, starting with

either serial number 1 or 2. This selection of the first cow was alternated between odd and even numbers from one smallholder unit to the other until investigation in all the 80 units was completed. Therefore, the cows selected in any individual smallholder unit were either all with odd or all with even serial numbers. In all the 80 smallholder units, a total of 306 dairy cows were selected for examination.

Evaluation of animal-level factors

The cows were examined individually for external signs on the body that served as evidence of poor animal welfare. These signs included traumatic lesions such as hair loss, swellings, ulcerations and scars on the skin particularly on the neck, the carpus, the hocks and on the bony prominences. Other important parameters evaluated on the cow were presence of sickness, body conditions score (BCS) and, soiling on the body particularly on the limbs, udder and flanks. Lameness and claw disorders were considered as significant indicators of poor welfare. Human-cow interaction was assessed by the investigator measuring the avoidance distance (in meters) of the cow from the approaching stockman, using a measuring tape. To do this, the stockman walked towards the shoulder of a stationary cow at 90° (i.e towards the side of animals body). He progressed towards the cow until the point at which it fled from him. The investigator measured the distance from that point where the stockman stopped to the point at which the cow was standing before fleeing.

Evaluation of housing design

The following parameters or factors relating to housing design were assessed: presence and adequacy of roofing, presence, type and state of walls, floor type, presence of resting yards, nature and adequacy of feeding bunk. All these were assessed by visual observation. Other parameters including: presence and height of neck rail, adequacy of walk area (alley), presence and size of cubicles which was assessed by taking actual measurements. The animals to cubicle ratio were also calculated.

Evaluation of feeding, watering regime and management practices

Parameters relating to feeding, watering and some aspects of management practices were assessed by interviewing farmers or stockmen and recording their responses in a questionnaire. The parameters and practices evaluated included: type of feed, frequency of feeding, type and frequency of mineral supplementation and frequency of watering. The state of feed and water was visually evaluated through direct observation by the investigator. Other parameters obtained by interviewing stockmen or farmers included: milking techniques, the udder hygiene practices during milking, use of milking jelly, frequency of slurry removal and methods of fodder preparation. Other investigations were disease control and prevention measures such as use of acaricides and vaccinations, and routine practices such as dehorning, trimming of claws, ear tagging, branding and deworming. The hygiene status of the floor, mixing cattle of different age groups and categories as well as different farm animal species were assessed through direct observation by the investigator during farm visits.

Collected data were entered and stored in Microsoft excel 2003. The data were cleaned and analyzed using SAS (Statistical Analytical System) © 2002 – 2003 (SAS Institute Inc., Cary, NC, USA) software. Descriptive statistics for the various body injuries were generated. Chi-square statistics were used to determine any associations between occurrence of specific body injuries and incriminated risk factors at $p < 0.05$ significance level.

Results and Discussion

General description of the smallholder set-up

A total of 306 dairy cows were examined in the 80 smallholder units evaluated in this study. The average number per farm was 5 adult cows and the median number was 4. The age of the cows ranged between 3-14 years, with an average of 7 years and median age of 6.50 years. The cows were of various breeds: 55.90% (171) were Friesian with average weight of 433 kg, 21.60% (66) were Ayrshire with average weight of 419 kg, 4.90% (15) were Guernsey with average weight of 299 kg, 1.30% (4) were Jersey with average weight of 388 kg, and 16.30% (50) were not pure but cross-breeds between any two of the pure breeds. These cross breeds had average weight of 340 kg.

Housing design and its implications

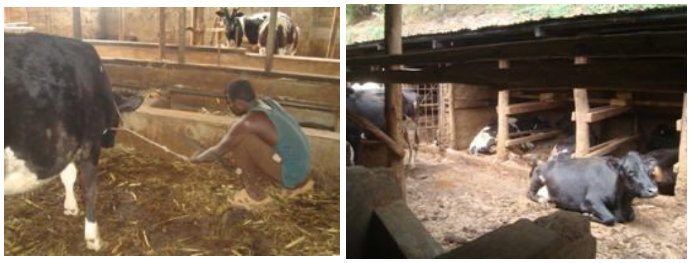
In the animal housing design, cow resting cubicles were present in 83.80% of the 80 smallholder units evaluated. Among these, a majority 74.6% had small cubicle sizes measuring between ≤1.80m long by ≤0.95m wide, 23.90% had cubicle sizes measuring between 1.95m to 2.20m long and 1.00m to 1.20m wide, and only 1.50% had large cubicles measuring ≥2.20m long by ≥1.20m wide. The divisions between some of these cubicles were made of poorly finished construction materials with protruding sharp edges and sometimes nail. Of the smallholder units that had cubicles, the animal to cubicle ratio was 1:1 in 59.70%, 2:1 in 20.90% and 3:1 or more in 19.40% of the units as summarized in table in 1 and photos 1a –d respectively.

Table 1: Details of the cubicle housing system in the farms evaluated for welfare of dairy cattle in the smallholder production systems in Nairobi and its environs (July 2009 – October 2009).

Parameter detail	Number of farms	Percentage of farms
Absence of cubicle housing system	13	16.25
Presence of cubicle housing system	67	83.75
Small-sized cubicles	50	74.60
Adequate cubicle sizes	16	23.90
Large-sized cubicles	1	1.50
Absence of kerbs	21	31.30
Presence of kerbs	46	68.70
Stocking rate of 1:1 (cows/cubicles)	40	59.70
Stocking rate of 1:2 (cows/cubicles)	14	20.90
Stocking rate of 1:3 (cows/cubicles)	13	19.40

a

b



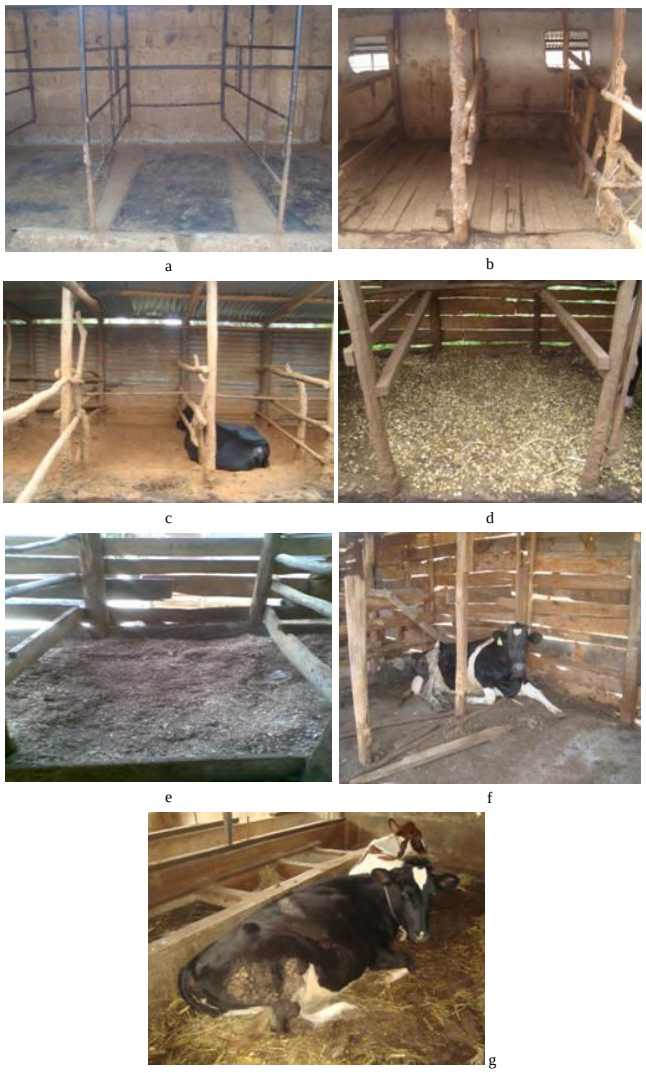
c d

Photo 1: Housing systems found in the 80 farms evaluated for welfare of dairy cattle in the smallholder production systems in Nairobi and its environs (July 2009 – October 2009). **a-** Cubicle housing. **b-** Common yard housing **c-** Neck tethering housing **d-** Cubicle housing system with 5 cows and 3 cubicles (Ratio 2:1) which resulted in some cows lying in the wet concrete floor or standing in the walk area.

The housing systems in the smallholder units in this study, greatly restricted the cows from freely expressing their normal behavior and enjoying free movement. The restricting sizes of the animal units in these farms are normally due to the small pieces of land owned and the financial constraints by these smallholder farmers, which makes it difficult for them to build cattle housing units with recommended dimensions (Webster 2005). This means that it may be difficult to guarantee the freedom of expression of normal behavior and movement for the cows in such smallholder farms. The restriction of movement is likely to predispose the cows to lameness (Greenough 2007). The particularly small size of cubicles found in these farms were contrary to what is recommended (Leaver 1983) and was incriminated as one of the factors that predisposed the cows to frequent injuries on the rib-cage, tuber coxae and ischial area, thus supporting previous findings (Weary and Tucker 2003). All these housing factors predisposing the cows to body injuries and lameness are associated with causing pain and suffering, hence poor welfare.

Cubicle beddings, walk alleys and the implicated injuries

In 53.80% of the 80 smallholder units, there was no bedding in the cubicles and other cow resting areas. Among these without bedding, 53.50% were bare earth because they were not concreted and 46.50% were left as bare concrete. Those smallholder units that had bedding in the cubicles or other cow resting areas, the bedding material consisted of sawdust/wood shavings (62.20%), rubber mats (21.57%), wheat straw (16.20%) or closely knitted wooden slabs (0.03%) as summarized in Photos 2a g.



a b

c d

e f

g

Photo 2: Cubicle bedding types in some of the 80 farms evaluated for welfare of dairy cattle in the smallholder production systems in Nairobi and its environs (July 2009 – October 2009). **a** – Rubber mat bedding, **b** - bare wooden cubicle floor, **c** - bare earthen cubicle floor, **d** - straw bedding, **e-** wood shavings bedding, **f-** bare concrete cubicle floor and **g-** tie stall with straw.

From the 80 smallholder units, 71.30% of them had walk-alley floors concreted and 28.80% were earthen (without concrete). Of those with concreted floors, 41.30% of them had grossly worn-out or pot-holed concrete, while 26.30% were smooth and slippery and only 32.50% had good textured non-slippery concrete.

The width of the walk alleys was quite narrow at ≤ 0.85m in 83.80% of the smallholder units and in 16.25% it was >1.20m.

Hock injuries were found to be significantly influenced by narrow walk alleys (χ^2=10.68, p<0.001). Injuries at the ischial area were significantly associated with poor quality (excessively rough and pot-holed) concrete floors (χ^2=8.86, p=0.012). Teat and udder injuries were found to have a significant association with bare concrete-floored cubicles (χ^2 =12.57, p=0.014) and also with the quality of cubicle bedding (χ^2=5.15, p=0.023).

The skin injuries observed in the current study were a reflection of the housing type and size, as well as the structures used to construct cattle houses. Similar injuries have been described in other studies (Whay et al 2003). Skin injuries in any part of the body of an animal are indicators of the welfare status of the animal particularly in relation to its environment. This is because these lesions are signs of pain and suffering (Main et al 2003). An environment that allows for free movement of the animal without risk of disease or injury is paramount (FAWC 1993; DEFRA 2003). The key predisposing factors to external body injuries are the restrictiveness of housing types and structures that affect the cows' behavioral patterns (Kiellard et al 2009). The external injuries observed in the cows in this study were mainly located on body protuberances such as the hock and the tuber coxae. Others were in the areas of the body subjected to pressure during recumbency and feeding times such as the brisket, ischial region, udder, rib cage, and neck. These findings are in agreement with previous reports (Zurbrigg et al 2005; Kielland et al 2009). In this study, although injuries at different parts of the body were attributed to different risk factors, they still related to the nature of the housing environment

Lack of bedding for cows to lie on in more than 50% of the cattle units in this study explains the association found between bare concrete floor in the cattle lying area and injuries on the ischial and udder regions. These observations are similar to those reported previously (Weary et al 2006). Provision of bedding in the resting areas of cattle housing units enhances cow-comfort (FAWC 1993; DEFRA 2003). Moreover, presence of comfortable bedding influences cow resting behavior positively by encouraging them to lie frequently on it and hence reduce the long hours of standing, which subsequently minimizes the risk of lameness (Nguhiu et al 2008; Rutherford et al., 2009), thus enhancing welfare of the cows. Sawdust was the main type of bedding found in these farms and this was attributed to its availability and low cost. However, its use is thought to be a risk factor for mastitis (Radostitis et al 2003) but in this study its presence had no association with mastitis. Use of other types of bedding was rare because they are too expensive for most smallholder farmers to afford.

Feeding bunk and its implications

Feeding bunks in 95% of the smallholder units were permanently in-built and were either made of concrete, wood or iron sheets, but in 5% of the units, open plastic containers or metallic feed troughs were used. The feeding bunks had high and sharply traumatic upper edges in 42% of the smallholder units. The space per cow at the feeding bunk was 0.50m in 67.50% of the smallholder units when all of them were feeding simultaneously, but less than 0.20m in 32% of the units. Neck rails over the feeding bunks were present in 60% of the units, but absent in 40% of the units. The neck rail heights from the upper edge of the feeding bunk were either ≤ 0.50m or >0.50m. Presence of neck rails over the feed bunk had significant association with injuries on the dorsal surface of the neck (χ^2=20.25, p<0.0001) and the brisket surface (χ^2= 8.14, p=0.0043), but the heights of the neck rails were found to influence presence or absence of injuries on the dorsal surface of the neck (χ^2=22.93, p<0.0001) and on the brisket surface (χ^2=7.37, p=0.025) as shown in photo 3a –d.

a b c d

Photo 3: Signs of injuries on the neck as observed in some of the cows among the 80 farms evaluated for welfare of dairy cattle in the smallholder production systems in Nairobi and its environs (July 2009 – October 2009). **a-** Hyperkeratosis and hair loss (red arrow), **b-** hair loss (bold arrow), **c-** wounds and scars (dotted arrow) and **d-**brisket injury.

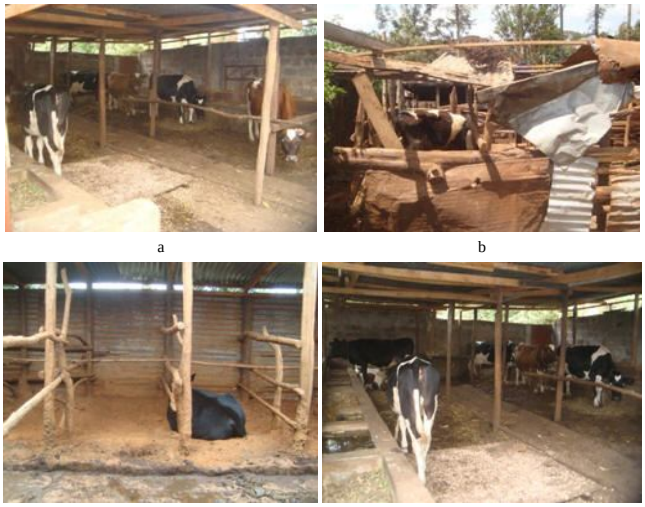
The preferred and recommended feeding bunk material is usually concrete because it can be made smooth during construction to eliminate sharp edges that would injure cattle as they feed (FAWC 1993; DEFRA 2003; Weary et al 2006). The few concrete feeding, bunks that were worn-out, and a high number of others that were made of iron sheets and wood, had sharp edges that predisposed the cows to injuries of the mouth, head and neck regions. High positioned feed bunks, whether made of concrete or other materials also predisposes the cows' to injury or abrasions of brisket area as they feed. Nails and iron sheet pieces are likely to break from the feeding bunk from time to time, and if ingested by the cows they can lead to disease. Therefore state of the feeding bunks as found in this study, exposed the cows to poor welfare. These findings on the feed bunks have not been documented previously.

The inadequate feeding bunk space per animal was a common feature in these smallholder dairy cattle units. This resulted in increased competitiveness and aggressive behaviour of the cows towards each other and particularly toward the subordinate ones during feeding time. Such behavior is likely to lead to physical injuries and reduced feeding time of the cows (Devries et al 2004; Endres et al 2005).

The low level of neck rails over the feed bunks was the main risk factor for injuries on the dorsal surface of the neck as shown in photo 3a –c above. This was the cause of hair loss and hyperkeratosis observed on the dorsal surface of the necks of cattle in this study. Similar findings have been observed previously (Kirkegaard et al 2003).

Roofing and walling of the houses and their implications

Cattle housing units were completely roofed over the cubicles, walk alley and feeding bunk areas in 35% of the 80 smallholder units evaluated, but partially roofed only over the cubicles and the feeding bunks in the remaining 65% of the units. The roofs were made of iron sheets in 87% of the units, wood in 10% and concrete in 3% of the units. In the smallholder units that had iron sheet roofing, 60% of them had partially collapsed roofs. The walls in the cattle housing units were made of either wood (43.75%), concrete (32.50%), or iron sheets (23.75%). In 75% of these units, there were protruding traumatic nails and sharp edges on the walls that were the main risk factors for rib-cage and tuber coxae area injuries photos 4a - d .



a b c d

Photo 4: State of iron sheet roofing and walling system in the farms evaluated for welfare of dairy cattle in the smallholder production systems in Nairobi and its environs (July 2009 – October 2009). **a-** Complete iron sheet roofing (curved arrow), **b-** collapsed iron sheet roofing (straight arrow) **c-** walls made of ironsheet and **d** -walls made of concrete.

Feeding regimes, body condition scores and their implications

The average body condition score of the cows examined was 2.20. Out of the 306 cows, 6% (19) had BCS of 1-1.50, 58% (177) had BCS of 2-2.50, 33% (100) had BCS of 3-3.5, and 3% (10) had BCS of 4-4.50. The body condition score (BCS) was found to be influenced by presence, amount and frequency of feeding concentrates, mineral supplementation and protein supplementation as summarized in table 2.

Table 2: Factors associated with the various body condition scores (BCS) in 306 cows examined in 80 farms evaluated for the welfare of dairy cattle in the smallholder production systems of Nairobi and its environs (July 2009 – October 2009).

BCS	Associated factor	Chi-square value (χ^2)	P value
1	Occasional concentrate feeding	14.77	0.022
	Absence of concentrate feeding	7.90	0.048
	Occasional mineral supplementation	49.87	<0.0001
	Absence of mineral supplementation	8.23	0.0415
2	Variation in frequency of concentrate feeding	22.69	0.012
	Regular concentrate feeding	13.29	0.021
	Regular mineral supplementation	12.02	0.035
3	High levels of concentrate feeding	35.65	0.017
	Variations in amounts of mineral supplementation	29.08	0.016
	Regular mineral supplementation	15.03	<0.01
	Regular concentrate feeding	13.19	0.022
4	Regular protein supplementation	14.46	0.0023

The association observed in this study between body condition status and the level of concentrate feeding demonstrates the benefit of concentrate inclusion in the diet. It further points out to the fact that lack of, and irregular concentrate feeding has a direct negative effect on the welfare of the cows. The stronger influence of occasional (irregular) concentrate feeding than its total absence on body condition score, can be attributed to the fact that when the cow's body is denied concentrates completely, it probably adjusts through compensatory mechanisms. Conversly, occasional feeding does not allow the body to adjust to one consistent system, but rather destabilizes it, hence negatively affecting the general welfare of the animal. This observation has not been reported previously.

The study also indicated that good body condition of the cows was enhanced when additional protein supplements were mixed with the concentrate feeds. These observations could be attributed to the fact that concentrates supply the primary nutrient requirements to the cow as well as sufficient reserves needed for secondary processes such as normal lactation (Kilgour and Dalton 1984; Lukuyu et al 2007), and increased milk production (Musalia et al 2007). Therefore, concentrates are pertinent constituents of the dairy cow diet if the stress of both body maintenance and milk production has to be avoided.

Regular mineral supplementation supplied in a majority of the farms in this study is a reflection of management practice, since minerals enhance animal growth, reproduction and health hence welfare of animals (Kilgour and Dalton 1984; Lukuyu et al 2007). In this study, the importance of mineral supplementation was evidenced by the association between regular supplementation and fair body condition, while occasional or absence of mineral supplementation was associated with poor body condition. Irregular mineral supplementation like was found with irregular concentrate feeding destabilizes the body more than complete absence of minerals. Hence, affecting body condition score that impacts negatively on the welfare of the cows. This observation has also not been reported previously. Findings from previous studies indicate that absence or insufficient mineral supplementation impacts negatively on growth rate and reproduction, leading to anoestrus (Kilgour and Dalton 1984; Roche 2006), and hence inevitably affecting animal welfare.

Animal and housing hygiene and its implications

Gross soiling with slurry on various areas of the bodies of the cows was observed in all the farms evaluated in this study. In all the cows examined, all their limbs were soiled. The flanks and udder were soiled in 97% and 90% of the cows, respectively. The factor found to have a significant association with soiling of flanks (χ^2=80, p<0.0001), limbs (χ^2=16.06, p<0.0011) and udder (χ^2=13.58, p=0.0035) was slurry accumulation in the cow house. Removal of slurry and cleaning of the cow housing floors was done at least once per day in 55% of the farms. In the remaining 45% of the farms, it was done only occasionally, either once per week or once every two weeks.

Mastitis and lameness were found to be the main conditions affecting the cows in the current study. This is similar to findings in other studies (Whay et al 2003). Lameness has been ranked as the major welfare disease of dairy cattle (Haskell et al 2006). However, in the current study mastitis had a higher prevalence than lameness. Both conditions are predisposed by slurry as one of the main risk factors (Somers et al 2003). The sharing of towels for washing the udders and failure to use germicidal teat dip may together with unhygienic conditions brought about by accumulation of slurry have made mastitis to have higher prevalence than lameness in the present study. In spite of this, lameness could still be considered the main condition affecting the welfare of the cows because, apart from causing pain and suffering, it does not only leads to discomfort that makes the cow change their behavior due to weight distribution but also interferes with the feeding behavior of the animals. Moreover, a lame cow lies down most of the time and in environments with accumulated slurry such as were found in the current study, this lying down precipitated by lameness would exacerbate occurrence of mastitis. Thus lameness also contributes to occurrence of mastitis in some situations (Somers et al 2003). The finding of claw lesions, particularly hoof overgrowth and laminitis as the main causes of lameness in the

cows in this study is in agreement with previous findings (Webster 2001; Nguhiu et al 2008).

Milking techniques and its implications

The milking protocols and practices as observed in this study are indicated in table 3.

Table 3: Milking protocols and handling of the udder during milking in the 80 farms evaluated for welfare of dairy cattle in the smallholder production systems in Nairobi and its environs (July 2009 – October 2009).

Milking practice	Number of farms	Percentage of farms
Machine milking	3	3.75
Hand milking	77	96.25
Warm water for udder cleaning	40	50
Cold water for udder cleaning	40	50
Common washing cloth	66	82.50
Individual washing cloth	14	17.50
Dirty drying cloth	61	76.25
Clean drying cloth	19	23.75
Rough drying towel	57	71.25
Smooth drying towel	23	28.75
Use of milking jelly	66	82.50
No milking jelly used	14	17.50
Teat pulling technique	59	76.60
Teat squeezing technique	18	23.40

The pin-point swellings found on the teats are thought to be linked to pox-related lesions from previous infections (Radostitis et al 2003), and were possibly spread from one cow to the other due to sharing of udder cleaning and drying towels during milking.

Stockmanship and its implications

The observation that sick cows were not attended to promptly in spite of the farmers and stockmen being aware of the sickness, reveals that these farmers and stockmen were unconcerned with animal suffering. This shows poor stockmanship and attitude towards animal welfare from the farmers and stockmen in this study. The poor perspective of farmers and stockmen on matters of animal welfare in the evaluated smallholder dairy units was attributable to the limited value they placed on animal well being. They focused more on benefits they obtained from the cows. This may be the reason they ranked animal feeding and watering highest in their perspective on animal welfare inputs as these have a direct association with milk production. These perceptives and attitudes of farmers and stockmen towards animal welfare have been a constant observation during clinical practice at the Animal Clinic, University of Nairobi (Clinicians' personal communication). Previous studies have revealed similar findings, that food and water are the most acknowledged needs for the animals (Aleri et al 2009).

Inconsistent record keeping found in the smallholder units in the current study makes it difficult to know the exact status of disease management, prevention and control as reported previously (Mills 2010). However the information given by the farmers and stockmen about disease management practices was taken with acceptable reliability based on past experiences of the clinicians at the University of Nairobi's Veterinary Clinic (Personal communication). Disease prevention practices such as vaccinations, deworming, claw trimming and tick control are presumed to be irregularly done in these farms, contrary to recommendations for prevention of controllable diseases and avoidance of unnecessary pain and suffering in animals (FAWC 1993; DEFRA 2003). Based on verbal information given, sick cows in these smallholder farms are treated after some time lag from the onset of disease clinical signs. This delay is likely to cause unnecessary pain and suffering to the cows. This could be attributed to the farmers' ignorance of the importance of animal welfare. Information given also tends to indicate that in these farms animals suffer pain when elective farm procedures such as dehorning and castration are carried out without operative analgesia and post-operative pain management. These omissions contravene the recommendations for carrying out such procedures (DEFRA 2003; GoK 2003).

Conclusions

- From this study it is concluded that; 1. poor welfare of dairy cattle exists in the smallholder production systems in Nairobi and its environs, 2.the risk factors of poor animal welfare in the evaluated smallholder dairy production systems are aggravated by the fact that these units exhibit extreme variations from one another, which results to "risky practices". They lack any standardization and the variations qualify them to be divided further into subunits. The variations that impacted on animal welfare included: substandard housing designs and structures, suboptimal feeding practices, substandard and poor management practices that include overstocking, poor hygiene and mixing of different age groups and categories of cattle. 3. Poor welfare existing in the smallholder units evaluated in the current study was evidenced by parameters prevalent on the examined cattle. These parameters included: injuries on animals, disease incidences such as lameness, mastitis and anoestrus, high incidence of agonistic and abnormal behavior, low body scores indicating poor body condition, reduced milk production. 4. The farmers and stockmen in these smallholder units had poor perception of animal welfare matters and poor attitudes towards animals. Owing to this ignorance, they mistreated the cattle in these units.

- There is need to expose smallholder dairy farmers to matters of good animal welfare practices through training and introduction to appropriate housing designs and emphasize the relationship between good animal welfare and productivity. There is also need for research into the impact of the risk factors identified in this study on the physiology and production performance of dairy cattle in smallholder production systems in Kenya.

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