

Health Constraints and Farm Management Factors Influencing Udder Health of Dairy Cows in Malawi

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Abstract

The aim of this study was to identify the major health problems and possible farm management practices which could be associated to the prevalence of mastitis in dairy cows kept in smallholder dairy farms in Malawi. A total of 140 randomly selected dairy farms were included in the study. Health problems were assessed using a semi-structured questionnaire and farm records. Physical examination and California Mastitis Tests (CMT) were used to determine the presence of clinical mastitis (CM) and subclinical mastitis (SCM). The most common diseases reported at farm level were mastitis 39.3% (55/140) and East Coast Fever 15.7% (22/140). Mastitis was the major udder disease and 52.0% (93/179) of the cows had at least one case of mastitis in the previous year. The prevalence of mastitis (positive result of physical examination or CMT) was significantly affected ($p < 0.05$) by history of mastitis, floor type, herd size, sanitation of stables and season of the year. Results of the present study suggest a need for targeted control measures against the major diseases identified. In addition, emphasis on management interventions with the aim to improve on the sanitation of stables is recommended in order to alleviate the negative impact of mastitis in dairy farms in Malawi.

Keywords: Smallholder dairy, Diseases, Mastitis, Management practices

1. Introduction

Smallholder dairy farming constitutes an important avenue for food production of animal origin in developing countries. In Malawi, smallholder dairy farming plays a central role in meeting the increasing demand for milk and milk products. In addition to the high nutritive value, milk production is an eminent income generating activity. Milk production is dominated by smallholder farmers who are organized in groups known as Milk Bulking Groups (MBGs) around the country's major cities. Farmers keep exotic breeds (mainly Holstein-Friesian

and Jersey) and their crosses with indigenous Malawi zebu on dairy farms with comparable management practices throughout the country (Banda et al., 2011a). This market oriented dairy farming is regularly subjected to various constraints such as poor animal health, inadequate farm management and deficient marketing systems for milk and milk products (Banda et al., 2011a; Tebug et al., 2012). Moreover, these exotic cattle breeds and their crosses are more susceptible to local diseases which may result to high morbidity and mortality.

Inflammation of the udder also known as mastitis has been reported as major animal health concern in smallholder dairy production systems. The prevalence of mastitis has been reported to vary with cattle breeds as well as farm management and environmental factors (Karimuribo et al., 2008; Phiri et al., 2010). The prevalence of mastitis assessed using California Mastitis Test (CMT) ranged from 38.1 to 75.9% in cows and 30.4 to 46.2% quarters in dairy cows in smallholder farms Ethiopia and Tanzania (Mungube et al., 2005; Karimuribo et al., 2008). Moreover, Mungube et al. (2005) estimated that 159 liters of milk per lactation could be gained by reducing subclinical form of mastitis from high (75.0%) to low (48.1%) prevalence rate in crossbred dairy farms in Ethiopia. In addition to reduction in milk yield, losses due to mastitis include cost incurred in treating sick cows, change in milk composition, decrease in milk quality, and increase in replacement of dairy cows (Thrustfield, 2007).

Considering the current focus on dairy cattle breed improvement as a means to improve on milk supply in Malawi, potential production constraints including animal health need to be identified and addressed. Hence, this paper reports on major health problems and possible farm management factors associated with the detection of both clinical and subclinical mastitis in dairy cattle reared by smallholder farmers in Malawi.

2. Materials and Methods

2.1 Study Area and Participating Farms

Data used in this study was collected from December, 2010 to June 2011 in two of the six administrative districts (Mzimba and Nkhata Bay) of the Northern Region of Malawi. Most (over 90%) of the dairy cattle population in the region is found in these districts (Banda et al., 2011b). The area is situated between latitude 11–13°S, longitude 33–35° E and has a subtropical climate with an average altitude of about 1, 200 meters above sea level. The rainy season lasts from November to April with a mean annual rainfall of 1,750 mm. The dry season lasts from April to October and the average annual temperature is 20°C. A table of random numbers (Thrustfield, 2007) was used to randomly select 140 farms from a 684 registered farmers at Mzuzu Agricultural Development Division. This provided 20.5% of the target population and animals in each farm were included in the study.

2.2 Survey for Health Problems and Examination for Mastitis

A pre-tested and structured questionnaire was used to collect information for the retrospective survey on animal health problems and farm characteristics. Farms were visited on a single day. Information contained in the questionnaire included herd composition, milking practices, floor type, sanitation, grazing system practiced. Farmers were asked to give a detailed description of diseases or health conditions that occurred on their within the previous year. Information from farm record was used when available. Health problems were grouped according to their similarities and body systems affected as previously described by Lema et al. (2001).

Alongside the questionnaire survey, udder and milk of all lactating cows present on each farm on the day of the farm visit were examined for both clinical and subclinical mastitis and non-functional or blocked (NFB) quarters. Changes in milk consistency or colour, abnormal secretions, size or consistency, increase temperature or pain upon palpation were considered indicative of clinical mastitis (CM). A cow was deemed to have CM if at least one quarter had either of the clinical finding indicative for clinical mastitis during the study. California Mastitis test (CMT; Bovi-Vet™, Kruuse, Germany) was carried out on all quarters with the exception of NFB. After the quarter was washed and dried, the first few squirt of milk was discarded and a few strips of milk were collected in a strip cup and checked for gross changes. About 5ml of milk was collected from each quarter into the respective wells of the CMT paddle and an equal volume of CMT reagent was added into each well. The paddle was swirled to thoroughly mix the contents for about 10 seconds. According to the amount of gel formed, the reaction was visually scored as “negative” (0), trace “(+)”, “weak positive” (++)”, “distinct positive” (+++) or “strong positive” (++++). Subclinical mastitis (SCM) was deemed present in a cow if a CMT score of + to ++++ was noted in one quarter. All examinations and data collection for this study were carried out by the same team comprising the principal investigator and a dairy extension personnel.

2.3 Statistical Analysis

Data obtained was entered into Microsoft Excel 2007 (Microsoft Corp) and later transferred in R statistical software (R Development Core Team (2011)). Multivariable logistic regression and odds ratio were used to assess the association between potential farm management factors and prevalence of mastitis in cows. The result of mastitis examination (positive or negative clinical examination and CMT) was used as the independent

variable while management factors were considered as dependent variables. The entire sampled population was used for the analyses of health problems while data from 18 lactating cows including those from 5 farms were omitted in the analysis management factors that could influence udder health because of missing values.

3. Results

3.1 Farm Characteristics and Health Problems

Over 50% of dairy animals in the selected farms were made up of lactating cows (Table 1). All farmers in the study practiced hand milking and one udder quarter is usually left for the un-weaned calf to suckle after milking is completed. The most prevalent disease groups were udder and infectious diseases. Mastitis and East Coast Fever were reported in 39.3% and 15.7% of farms included in the study, respectively (Table 2, Figure 1).

3.2 Udder Health and Associated Farm Management Practices

A total of 152 lactating cows and 608 quarters (teats) were subjected to clinical examination and California Mastitis Test. Clinical mastitis was observed in 17 cows (11.2%) while subclinical mastitis was detected in 78 (51.3%) cows and 263 (43.6 %) quarters. Four cows (2.6%) had non-functional or blocked quarters, with a total of 5 teats (0.8%) affected. The percentage of cows having mastitis (both clinical and subclinical) was significantly ($p < 0.05$) affected by history of mastitis, floor type, herd size, sanitation of stable and season of the year (Table 3). A higher percentage mastitis were observed in cows that had at least one case of mastitis in the previous year, those housed on cemented floors as well as dirty and wet floors in cows during the raining season.

4. Discussions

4.1 Farm Characteristics and Health Constraints

The herd size of one to six cattle with an average 2.4 is comparable with 2.2 to 3.5 cattle per farm reported in other Regions of Malawi (Chagunda et al., 2006; Banda et al., 2011a). However, very little increase in average herd size was observed (2.4 vs. 2.2) when compared to results of a previous study in the same study area two years earlier (Tebug et al., 2012). The relatively stable herd size observed might be due to low calving rates based on artificial insemination records, which is prominent in the Northern Region of Malawi (Banda et al., 2011b). Moreover, other studies carried out in smallholder dairy farms in East African countries including Malawi identified inefficient reproductive management as a major challenge to dairy development (Banda et al., 2011b; McDermott et al., 2010; Tebug et al., 2012).

Results of this study revealed that mastitis and East Coast Fever were the major health constraints encountered in dairy farms, with more than half the number of cows reported to have had mastitis at least once in the previous year. This result agrees with Tebug et al. (2012) where poor animal health was found to be second major constraints to 210 smallholder dairy farmers two years earlier (Tebug et al., 2012). Furthermore, mastitis was the most reported cause of morbidity in 65 studies carried out in smallholder dairy farms in East and South African (ESA) countries (Lema et al., 2001; Phiri et al., 2010). The high prevalence of mastitis in farms is not only a hygienic problem, but also lowers income of the dairy producers and decreases animal welfare. Metabolic diseases were among the least reported health problems. This could be attributed to low milk production of dairy animal estimated at 5-15 liters per day per cow (Chagunda et al., 2006; Tebug et al., 2012) or to the lack of sufficient understanding of metabolic disease by farmers.

4.2 Udder Health and Associated Farm Management Practices

The prevalence of mastitis in our study was lower at quarter (cow) level 43.3 vs. 68% (59 vs. 61%) but was within the range 22.0 – 84.5% (2.1 – 90.0%) reported by fifteen authors in ESA countries (Phiri et al., 2010). All farmers left one quarter for the un-weaned calf to suckle after milking is completed. According to Phiri et al. (2010), residual calf suckling is negatively associated to mastitis and could explain the relatively lower detection rate observed. However, there were several factors associated to higher prevalence of mastitis in our study.

The percentage of cows having mastitis was higher in cows with a history of mastitis. This is in agreement with the report of Mungube et al. (2004) and Abera et al. (2010) in Ethiopia. It was however different from Abera et al. (2012) who reported no significant influence of previous history on the detection of mastitis in dairy cows.

Cows housed on concrete floors tend to have more mastitic quarters than those housed on earth and brick floors. This observation differs from that of Abera et al. (2010). Cow pens in the study area are mostly roofed with thatches which do not usually cover the entire pens and leak during the raining season. When these pens are not cleaned on regular basis and in the presence of manure and dairy slurry, concrete floors as opposed to earth floors favor the accumulation of moisture, hence, a good milieu for bacteria to thrive.

Similarly, the percentage of cows having mastitis was found to be lower in cows housed in stables with clean and dry floors compared to cows housed in dirty and wet floors. The same observation was made in farms with more

than two animals as oppose to those with less than three animals and suggest that sanitation was a major predisposing factor for the prevalence of mastitis in dairy cows in Malawi. This suggestion is in line with Kudi et al. (2009) who reported variation in bacteria number between different floor beddings. The same author identified a relationship between the number of bacteria within the bedding material and the number of bacteria on the teat end of cows. Hence, need exist to improve on farm management practices aimed reducing contact of teat with mastitis causing pathogens from the cow's environment in order improve on udder health in dairy cows in Malawi.

Milk production in Malawi increased by 1.1% every year between 1999 and 2009 and the per capita milk consumption is estimated at 4.5-6 kg (DAHLD, 2005; FAO, 2011). This increase is far below the 4.0% annual increase for developing countries projected between 1999 and 2020 by Delgado et al. (2001). In order to attain the projected per capita milk consumption of 30 kg for sub-Saharan Africa by 2020 (Delgado et al. 2001), more effort is needed to increase milk production and to reduce losses along the entire dairy production chain. According to Chimbaza (2011), poor milk quality is a major cause for losses and reduced earnings by smallholder farmers in Malawi. Further, Chindime (2007) estimated that 17% of milk produced and sold through the formal market channel is rejected because of poor quality. Our results reveal that mastitis and infectious disease such as East Coast Fever are the most frequent health constraints to smallholder dairying in Malawi. Therefore, disease prevention and control measures taking into consideration factors identified are recommended as a means to increase milk production as well as producers' earnings and to improve on the quality of milk sold to consumers.

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Table 1. Average herd composition of 140 smallholder dairy farms (December 2010-June 2011)

Class	Composition per farm (Mean, range)	Total number of cattle (number, %)
Lactating cows	1.2 (0-3)	170 (51.1)
Non lactating cows	0.1 (0-2)	9 (2.7)
Heifers (post weaned, pre-calving)	0.4 (0-2)	49 (14.7)
Bulls (post weaned)	0.2 (0-2)	22 (6.6)
Calves (pre-weaned, male and female)	0.6 (0-2)	83 (25.1)
Total	2.4 (1-6)	333 (100)

Table 2. Distribution common diseases and conditions as reported per smallholder dairy farm (2010-2011)

Disease group	Diseases or conditions	Number of cases	Number of farms (%)
Udder diseases	Mastitis	88	55 (39.29)
	Blocked quarters	5	4 (3.57)
Specific infectious diseases	East coast Fever	27	22 (15.71)
	Infectious bovine keratoconjunctivitis (Pink eye)	10	8 (5.71)
	Black quarter	10	6 (4.29)
Locomotory conditions	Lumpy skin disease	1	1 (0.71)
	Lameness	7	5 (3.57)
Respiratory conditions	Enlarged joints	1	1 (0.71)
	Difficult breathing	4	4 (2.86)
Metabolic diseases	Cough	2	2 (1.43)
	Milk fever	3	3 (2.14)
Gastrointestinal disorders	Worms	10	7 (5.00)
	Diarrhea	4	4 (2.86)
	Ingestion of plastic objects	1	1 (0.71)
Reproductive diseases	Retained Placenta	8	8 (5.71)
	Abortions	2	2 (1.43)
	Difficult birth	2	2 (1.43)
	Repeated breeders	2	2 (1.43)
	Still birth	1	1 (0.71)
Others	Unknown	5	5 (3.57)
	Abscess	1	1 (0.71)

Table 3. Management practices associated with the detection of mastitis in dairy cows (152 cattle from 135 farms)

Variable	Level	Number of cows examined	With mastitis (%)	Coef.	SE	Odds ratio (95% CI)	P-value
History of Mastitis within the last 1 year	Absent	91	47 (51.6)				
	Present	61	42 (68.9)	1.168	0.424	3.21 (-0.07, 0.78)	0.006
Feeding method	Grazing	22	18 (81.8)				
	Stall feeding	130	71 (54.6)	-0.751	0.671	0.47 (-2.17, 0.51)	0.262
Floor type	Earth	135	76 (56.3)				
	Cement	17	13 (75.5)	1.880	0.764	6.56 (0.48, 3.52)	0.0138
Herd size	≥ 3	58	35 (60.3)				
	< 3	94	54 (57.4)	-1.189	0.467	0.30 (-2.14, 0.30)	0.011
Sanitation of Stable	Good	63	26 (41.3)				
	Bad	89	63 (70.8)	1.514	0.428	4.55 (0.70, 2.38)	0.000
Number of Milking practices	≤ 3	78	55 (70.5)				
	> 3	74	34 (45.9)	-0.572	0.417	0.56 (-1.39, 0.24)	0.170
Season	Dry	37	11 (29.7)				
	Raining	115	78 (67.8)	1.592	0.516	4.91 (0.61, 2.65)	0.002

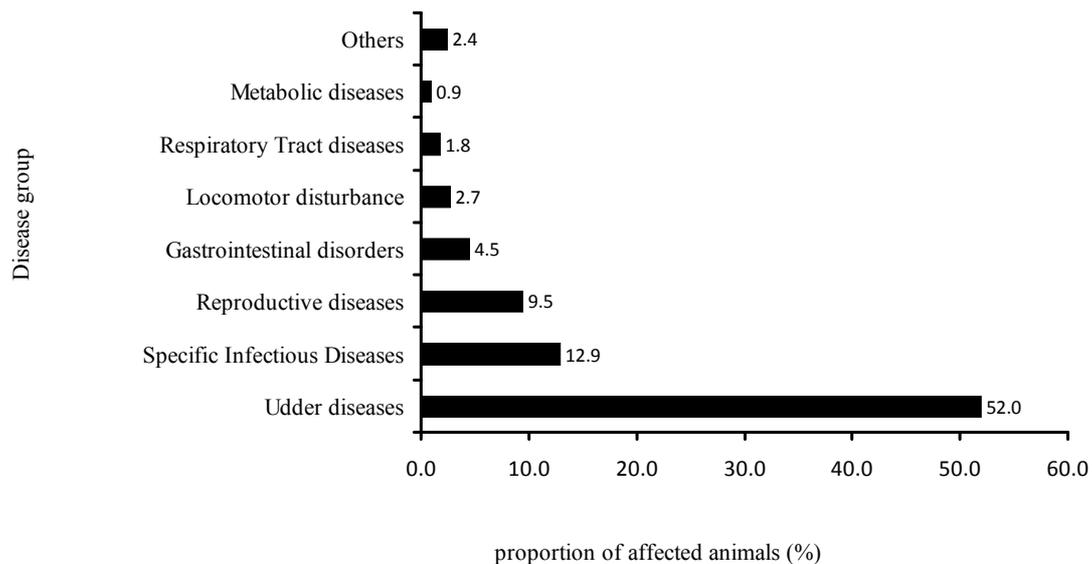


Figure 1. Proportion of affected animals per susceptible disease group as reported in 140 dairy farms