Small-scale dairy farming plays a significant role in many tropical and sub-tropical developing countries. It is faced with several disease challenges (Gitau et al. 1994; Gitau et al. 1999; Gitau et al. 2010) and more recently many welfare issues and concerns have been reported as impacting negatively on the industry (Aleri et al., 2011; Aleri et al. 2012). Welfare implications reported include; poor feeding and management practices, inappropriate housing and some welfare diseases (mastitis, body injuries, lameness and anoestrus) (Nguhui et al. 2009; Aleri et al. 2012). Losses due to mastitis are ranked highest in the dairy industry (Huijs et al. 2009). Its risk and predisposing factors are well elaborated (Nyman et al. 2007; Olde Riekerink et al. 2007; Moussavi et al. 2012). In Kenya, several risk factors have been reported (Abuom et al. 2011). However, data on milking practices used by the farmers are not available hence the need for the current study. The aim of this study was to determine status and educate the small-scale dairy farmers in Nairobi area on milking practices and its implications on mastitis.

Materials and Methods

Study area

This cross-sectional study was carried out in peri-urban areas of Nairobi, Kenya which included parts of Kambio, Kikuyu and Kajado Districts between July and October 2009. 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. The study area has two main agro-ecological zones the lower highland with an altitude of between 1820 m and 2070m and the other upper midland with an altitude of between 1200 m and 1820 m above sea level. The peri-urban areas included in the study were located North, South and West of the City. Nairobi has an estimated population density of over 3017 persons per square kilometer. It has a high number of smallholder dairy production units whose increase is encouraged by availability of a ready market for milk in the city. In some of the less densely populated suburbs dairy cattle are also reared.

Study design and Data Collection

A total of 80 smallholder dairy units were included in the study. The study area was divided into 4 zones, which were named North, South, West and Central, with Nairobi suburbs as the Central zone. Each zone was further subdivided into 4 subzones. From each zone 20 smallholder units were selected. They were selected purposively by the help of local veterinarians and Animal Health Assistants with whom the farmers were more acquainted. In this study, a smallholder dairy unit was defined as one with a minimum of 3 and a maximum of 16 adult dairy cows. Data were collected using semi-structured questionnaires by interviewing the farmers. Data collected involved milking practices adopted by the farmers. Data were checked for any entry errors and thereafter entered in Microsoft Excel (2003).

Results

General descriptions

A total of 80 smallholder units were 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% were Guernsey with average weight of 299 kg, 1.30% 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 an average weight of 340 kg. Milking was done twice/day approximately twelve hours apart and the daily milk yield in the evaluated farms ranged from 2.5 litres to 30 litres per cow. The average was 11.38 ± 5.91 litres per cow.

**Milking areas**

None of the farms evaluated in this study had a milking parlour. Instead, improvised cubicles were used as milking areas (Figure 1) in 76% of the farms. In the remaining 24% of the farms, cows were milked in their respective milking areas or cubicles. In 61% of the farms, the improvised milking cubicles measured less than 1m X 0.95m and in the remaining 39%, they measured more than 2m X 1m. In 49% of the farms, the cubicles in which milking was done had protruding objects such as nails and sticks.

**Milking routines/practices**

The routine practices carried out during milking in the farms that were evaluated are summarized in Table 1. Tying of the cows' hind limbs during milking was routinely practiced in 82.5% of the farms. Udder cleaning before milking was done in all the farms and in half of them, warm water was used for cleaning while in the other half cold water was used. In a majority (82.5%) of the farms, the cows had their udders washed using a common udder towel. In 76.25% of the farms, the udder drying towels were grossly dirty. In 71.25% of the farms, these udder drying towels were rough in texture. In 96.25% of the farms, hand-milking was done. The stockmen milked the cows by pulling the teats in 76.6% of the farms, while in 23.4% they milked by squeezing the teats. Machine milking was done only in 3.75% of the farms (Figure 2). Lubrication of the teats with milking jelly before milking was routinely done in 82.5% of the farms, but no milking jelly was used in the remaining 17.5% of the farms. Cows in farms where no milking jelly was used prior to milking, kicked and were restless during milking periods.

**Discussion**

The results of this study indicated that the milking practices adopted by dairy farmers in the smallholder systems in Nairobi and its environs were unique and variable and majority were unconventional. The lack of conventional milking parlours for the farmers in this study was mainly due to lack of funds to set-up the milking parlours and probably the few number of cows per farm. This lack of infrastructure resulted in the adoption of unique milking parlours at the farms which were poorly constructed or the use of resting areas for milking which had hygiene implications. These observations have not been reported previously.

![Figure 1: Areas used for milking in some of the farms evaluated for milking practices in the smallholder dairy production systems in Nairobi and its environs (July 2009 - October 2009). A- cow being milked in a cubicle and B- a stockman milking a cow in one of the cubicles with protruding sharp objects.](image-url)
Figure 4.20: The use of milking machine in 3 out of the 80 farms evaluated for milking practices in the smallholder dairy production systems in Nairobi and its environs (July 2009 – October 2009). A- Portable type of milking machine; B- a stockman preparing to use the portable milking machine.

Table 1: Milking protocols and handling of the udder during milking in the 80 farms evaluated for milking practices in the smallholder dairy production systems in Nairobi and its environs (July 2009 – October 2009).

<table>
<thead>
<tr>
<th>Milking practice</th>
<th>Number of farms</th>
<th>Percentage of farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine milking</td>
<td>3</td>
<td>3.75</td>
</tr>
<tr>
<td>Hand milking</td>
<td>77</td>
<td>96.25</td>
</tr>
<tr>
<td>Warm water udder cleaning</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Cold water for udder cleaning</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Common washing cloth</td>
<td>66</td>
<td>82.50</td>
</tr>
<tr>
<td>Individual washing cloth</td>
<td>14</td>
<td>17.50</td>
</tr>
<tr>
<td>Dirty drying cloth</td>
<td>61</td>
<td>76.25</td>
</tr>
<tr>
<td>Clean drying cloth</td>
<td>19</td>
<td>23.75</td>
</tr>
<tr>
<td>Rough drying towel</td>
<td>57</td>
<td>71.25</td>
</tr>
<tr>
<td>Smooth drying towel</td>
<td>23</td>
<td>28.75</td>
</tr>
<tr>
<td>Use of milking jelly</td>
<td>66</td>
<td>82.50</td>
</tr>
<tr>
<td>No milking jelly used</td>
<td>14</td>
<td>17.50</td>
</tr>
<tr>
<td>Teat pulling technique</td>
<td>59</td>
<td>76.6</td>
</tr>
<tr>
<td>Teat squeezing technique</td>
<td>18</td>
<td>23.4</td>
</tr>
</tbody>
</table>

Washing of the udder and teats before milking as found in this study is in conformity with good udder hygiene practices (Radostits et al. 2003; Radostits et al. 2007). However, the use of cold water rather than warm water may be uncomfortable to the cows, and is contrary to the general recommendations that enhance the comfort of the cows during milking (DEFRA 2003). In addition to this, the use of the same piece of cloth or towel for washing and drying udders of several cows, was a poor animal welfare practice. It increases the risk of developing udder infection, which can be transmitted easily from one cow to another. This is contrary to recommended udder hygiene guidelines (Codes of Practice 2009; Radostits et al. 2003). Furthermore, these towels which were of rough texture in a majority of farms were always causing discomfort to the cows during use. The routine use of milking jelly to lubricate the teats before milking was a good animal welfare practice. However, failure to have germicidal teat dips for disinfecting the teats post-milking could
increase the risk of mastitis because of the likelihood of transmitting pathogens between animals by milkers’ hands, dirty tools, shared udder cleaning and drying tools, as well as pathogens from the environment (Philpot 1979; Radostits et al. 2007).

There is need to adopt the practice of post milking teat dipping because of its ability to reduce environmental mastitis by 50% in some herds (Blowey and Edmondson 2010). The financial status of most of the smallholder farmers in this study makes it difficult for them to afford and maintain milking machines. Hand-milking in these farms is therefore, the only option. The teat-pulling hand milking technique that was employed by most of the stockmen in these farms was the cause of pain and discomfort during milking and was due to ignorance by the farmers.

References

Aleri, J.W., Njuki-Mwangi, J. and Moga, E.M., 2011. Housing design as a predisposing factor for injuries and poor welfare in cattle within smallholder units in periurban areas of Nairobi, Livestock Research for Rural Development 23(3)


Abuom, T.O., Ng’eng’a, M.J., Wabacha, J.K., Tsuma, V.T. and Gitau, G.K., 2012. Incidence and risk factors of periparturient conditions in smallholder dairy cattle herds in Kikuyu Division of Kiambu District, Kenya, Ethiopian Veterinary Journal, 16 (2)


Gitau, G.K., Perry, B.D. and McDermott, J.J., 1999. The incidence, calf morbidity and mortality due to Theileria parva infections in smallholder dairy farms in Muranga, District, Kenya. Preventive Veterinary Medicine, 39 (1), 65-79


Ng’eng’a, M.W., Mbuthia, P.M.F., Wabacha, J.K. and Mbuthia, P.G., 2009. Factors associated with the occurrence of claw disorders in dairy cows under smallholder production systems in urban and peri-urban areas of Nairobi, Kenya, Veterinarski Arhiv 79(4), 345-355

