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## Dairy producer's attitudes toward implementing calf management practices on smallholder and large commercial dairy herds in Kenyan Rift valley

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### Abstract

Practicing best calf management practices in housing, feeding and health are important for growing the future replacement stock. This is important for sustainability of the dairy herd where a significant proportion of the national dairy herds are smallholders with poorer calf performance than is in large commercial herds. Kenya's national dairy herds comprise over 75% smallholders, some affiliated to cooperatives offering regular extension advises on best calf management practices to their members. This study tested the hypothesis that producer attitudes reflect calf management practices that are implemented in large commercial and smallholder herds. The hypothesis was tested with a sample of large commercial dairy herds and smallholder herds affiliated to cooperative societies. Producer attitudes and management practices in calf housing, feeding and health were captured regarding standard management practices on a five point scale of agreement. The responses were analyzed to reveal the underlying differences between the herds using non-parametric chi square test and Mann-Whitney U test statistics. Compared to large commercial dairy producers, smallholders expressed more negative ( $p < 0.05$ ) attitudes towards practicing the recommended housing (calf pen disinfection, spacing in pen, bedding), feeding (colostrum feeding, concentrate supplementation) and towards health (vaccination, deworming and ecto parasite control). The negative smallholders' attitudes were reflected in poorer ( $p < 0.05$ ) implementation of the recommended calf housing practices (pen disinfection), feeding practices (colostrum and milk feeding, concentrate supplementation and weaning procedure) and health practices (vaccination and ecto parasite control). To attain improved calf performance and sustainable dairy herds, smallholder dairy producers need change of attitude towards implementing the recommended calf management practices. In housing, the target areas are pen disinfection, housing calves in individual pens to avoid crowding and improved bedding. In feeding, the target areas are colostrum and milk feeding and concentrate supplementation while in health the target areas are vaccination, deworming and ecto parasite control practices.

**Keywords:** Calf feeding, calf health, calf housing, calf performance, replacement stock

### Introduction

Practicing best calf management practices in housing, feeding and health is important for rearing the future replacement stock. This is important for sustainability of the dairy herd where a significant proportion of the national dairy herd attain poorer calf performance. Kenya has such dairy herd in which smallholder's comprise 75% of the national herd and with poorer calf performance than in the fewer remainder medium and large commercial herds [3]. Good calf management practices enhance calf survivability and performance and subsequently, quality replacement stock for the future herd [17].

Important calf management is in housing, feeding and health. Calf housing should be well ventilated, partitioned into individual pens which are regularly disinfected, cleaned and the bedding are kept dry to provide calf comfort, good welfare and ease early disease detection of diseases. This way, good housing contributes to improved calf performances [5]. Good calf feeding practices begin with colostrum feeding, essential for passive immunity to calf. Colostrum feeding is followed with milk feeding, which has to be warm, hygienic and in enough quantity corresponding to calf body weight to support sufficient growth. Supplemental concentrate is necessary after weaning to sustain high growth rates [16, 4].

Poor calf health is associated with calf mortalities from pneumonia, diarrhea and septicemia diseases. Poor calf health slow growth rate and limits daily body weight gain<sup>[7]</sup>. Routine disease management such as control of ecto-parasites, vaccination and treatment adhered reduces mortality rates and cost of antibiotics<sup>[14, 6]</sup>.

## Materials and methods

### Ethical approval

The study was approved by National Commission for Science, Technology and Innovation

**Informed consent:** The study was discussed with owners of the animals who were to be recruited and thereafter they signed written consent. They were free to make the decision to join the study or withdraw.

### Study site and sampling procedure

The study was done in Nakuru County which has a bimodal rainfall pattern with 1800mm rainfall during the long rains between March, April, May and June and 500mm rainfall during short rains between October and November. The county is generally warm and temperate with an average temperature of 17.5 °C (Egerton University Meteorological Station 2018).

A sample 20 in the ratio of 1:4 (large commercial: smallholder dairy) farms was obtained. This corresponds to the national herd in which smallholders are over 75%. The farms were randomly selected in four different locations where both large commercial farms and cooperative smallholder dairy farms were accessible. The smallholder herds were affiliated to four dairy farmer cooperatives.

### Data collection and analysis

Data was collected on producer attitude and calf management practices on housing, feeding and health using structured questionnaire administered to farm owners. A set of statements describing standard management practices were put to farmers to which they responded with a five point

Likert scale: 1=strongly disagree, 2=disagree, 3=undecided, 4=agree and 5= strongly agree. These ordinal scale measures captured farmer attitudes to calf standard practices and if are implemented in the herd. The responses were subjected to statistical significance testing between smallholder and large commercial producers using non parametric chi square test and mean rank test with Mann-Whitney U test statistics.

## Results

### Producer attitudes

Table 1 shows the attitudes of smallholders and large commercial dairy producers towards best practices recommended for calf housing, feeding and health management. Compared to large commercial producers, smallholders expressed more negative ( $p<0.05$ ) attitude towards practicing recommended housing (pen disinfection, crowding, bedding), feeding (colostrum and concentrate supplementation) and health (vaccination, deworming and ecto parasite control) management. However, attitudes towards pen ventilation, calf grouping and treatment were not different ( $p>0.05$ ) between large commercial and smallholder herds.

### Producer management practices

Table 2 shows implementation of the recommended calf management practices by smallholder and large commercial dairy producers. Compared to large commercial dairy producers, smallholders were poorer ( $p<0.05$ ) in implementing recommended calf housing practices (pen disinfection), feeding practices (colostrums and milk feeding, concentrate supplementation and weaning procedure), and health practices (vaccination and ecto parasite control). However, they concurred on bedding and deworming practices. However the result showed some concurrences ( $p>0.05$ ) in housing practices (use and frequency of bedding changes, grouping of calves), feeding practices (weaning procedures, feeding of colostrum, milk allowances at the peak and source of animal feed) and health practices (deworming, treatment of sick calves and use of anthelmintics).

**Table 1:** Producer attitudes towards recommended calf housing, feeding and health management practices

Variable	Farm	*Median (mean rank)	p-value
Pen disinfection is important	Smallholder	3.0 (8.7)	0.003
	Large commercial	5.0 (17.8)	
Pen disinfection should be done frequently	Smallholder	3.0 (8.8)	0.005
	Large commercial	5.0 (17.5)	
Calves should be grouped	Smallholder	3.0 (9.5)	0.148
	Large commercial	5.0 (14.4)	
Calf pen should well ventilated	Smallholder	4.0 (10.1)	0.617
	Large commercial	5.0 (12.0)	
Calf bedding is important	Smallholder	2.0 (8.8)	0.005
	Large commercial	5.0 (17.5)	
Beddings should be changed	Smallholder	3.0 (8.8)	0.007
	Large commercial	5.0 (17.3)	
Abrupt weaning is good for calves	Smallholder	2.0 (12.4)	0.002
	Large commercial	1.0 (3.0)	
Calves should be fed on a particular plan	Smallholder	3.0 (8.9)	0.011
	Large commercial	5.0 (16.9)	
Newly calf born should be fed with colostrum	Smallholder	3.0 (8.9)	0.011
	Large commercial	5.0 (16.9)	
Calves should be supplemented with concentrates	Smallholder	3.0 (8.8)	0.007
	Large commercial	5.0 (17.3)	
Vaccinating dairy calf is important	Smallholder	3.0 (9.1)	0.029
	Large commercial	5.0 (16.3)	
Dairy calves should be treated	Smallholder	1.0 (10.2)	0.793
	Large commercial	1.0 (9.0)	
Control of ecto parasites in my farm is important	Smallholder	2.0 (8.8)	0.007

	Large commercial	5.0 (17.1)	
Use of anthelmithes is important	Smallholder	1.0 (8.7)	0.003
	Large commercial	5.0 (17.6)	

\*Response a five point Likert scale: 1=strongly disagree, 2=disagree, 3=undecided, 4=agree and 5= strongly agree.

**Table 2:** Producer management practices on calf housing, feeding and health

Variable	Farm	*Median (Mean ranks)	p-value
Do you disinfect your calf pen	Smallholder	3.0 (9.2)	0.050
	Large commercial	5.0 (15.8)	
Frequency of pen disinfection	Smallholder	3.0 (12.3)	0.003
	Large commercial	1.0 (3.4)	
Do you use bedding in your farm	Smallholder	3.0 (9.7)	0.211
	Large commercial	4.0 (13.9)	
Frequency of bedding changes	Smallholder	5.0 (10.8)	0.617
	Large commercial	5.0 (9.1)	
Do you group your calves	Smallholder	2.0 (11.0)	0.494
	Large commercial	1.0 (8.5)	
Do you wean your calves abruptly?	Smallholder	2.0 (10.0)	0.494
	Large commercial	2.0 (12.5)	
Do you feed your calves with colostrum	Smallholder	4.0 (9.0)	0.022
	Large commercial	5.0 (16.5)	
Do you feed calves on specific plan	Smallholder	2.0 (8.7)	0.003
	Large commercial	4.5 (17.8)	
Amount of colostrum fed to calves	Smallholder	4.0 (9.8)	0.810
	Large commercial	4.5 (10.8)	
Amount of milk fed to calves at start	Smallholder	4.0 (9.2)	0.039
	Large commercial	5.0 (15.9)	
Amount of milk fed at the peak	Smallholder	2.0 (9.6)	0.178
	Large commercial	4.5 (14.3)	
Amount of concentrates fed to calves	Smallholder	2.0 (8.5)	0.000
	Large commercial	5.0 (18.5)	
Source of animal feed	Smallholder	3.0 (9.9)	0.385
	Large commercial	3.0 (13.0)	
Do you vaccinate your calves	Smallholder	2.0 (8.7)	0.002
	Large commercial	5.0 (17.9)	
Do you deworm your dairy calves?	Smallholder	1.0 (10.9)	0.617
	Large commercial	1.0 (9.0)	
Do you treat sick calves	Smallholder	4.0 (9.9)	0.385
	Large commercial	5.0 (13.0)	
Do you control ectoparasites in your farm?	Smallholder	2.0 (12.1)	0.011
	Large commercial	1.0 (4.0)	
Do you use antihelmithis	Smallholder	1.0 (11.3)	0.290
	Large commercial	1.0 (7.5)	

\*Response a five point Likert scale: 1=strongly disagree, 2=disagree, 3=undecided, 4=agree and 5= strongly agree.

## Discussion

Compared to large commercial producers, smallholders were more ( $p < 0.05$ ) negatively in attitudes, with the negative attitudes they were poorer ( $p < 0.05$ ) in implementing the recommended calf management practices. Smallholder considered disinfection of calf housing as less important. This encourages an environment favorable for multiplication of diseases pathogens which hinders calf performance<sup>[5]</sup>. This is in agreement with<sup>[18]</sup> who observed relationship between pen disinfection and calf performance. With regard to calf housing specifications, the recommended pen spacing should be observed however, the smallholder's pen was not corresponding to the standard spacing of 95 by 135cm as pointed out by<sup>[8, 1]</sup>. Farmers should maintain the recommended pen spacing, the larger the size of the pen the more the lying behavior and vice versa this behavior is influenced by pen area per calf, type of floor, type of bedding, and weather conditions.

Well ventilated calf pen helps in reducing the incidences of respiratory diseases due to minimization of air borne pathogen load<sup>[5]</sup>. There was no variation attitude between producers in providing ventilation to calf pen. This facilitates in enabling early detection of disease infections and treatment of sick

calves. A well ventilated pen reduces pathogen loads in the calf pen<sup>[10]</sup>.

The calves kept in a separate pen promotes calf performance as it avoids risks for direct contacts and risks of disease transmission via feeding and drink troughs<sup>[11]</sup>. Single housing is in agreement with the reports by<sup>[18]</sup> which indicates that majority of the dairy farmers are practicing individual pen. Individual calf pen is important in ensuring calf performance since it provides isolation of calves, minimizes stress, reduces competition for feed hence improved performance.

Calf housing should be clean, dry and well ventilated, properly spaced this serves for good management. Basing on these facts, the research found both smallholder and large commercial dairy farmer were providing individual calf pen. However there was significance difference on how the farmer practiced bedding together with frequencies of bedding changes. The large commercial was in agreement with the dos' of the newborn calf management strategies by providing with bedding in the individual pen and changing the beddings should frequently. The habit of not changing the calf bedding compromises with dairy calf health consequently calf performance in that wetness can interfere with thermoregulation hence negative impact on dairy calves<sup>[14]</sup>.

By providing good housing to the calf, it helps in controlling heat stress which has direct relationship with the feed intake and so influencing growth. Housing was significantly different between smallholder and large commercial dairy herds whereby some of the smallholders were keeping their calves in enclosed houses and or kitchen. Housing practice management system needs to be adjusted according to heat or cold weather to enable calves withstands critical temperatures for better performance <sup>[10]</sup>. Properly designed and managed calf housing helps in providing thermal comfort zone. This is achieved through minimal extreme climatic due to reduced thematic stress because there is direct relationship between the type of housing and respiratory disease <sup>[15]</sup>.

Attitudes and feeding management practices of the newly calf with colostrum, concentrates and feeding plans greatly affects calf performances <sup>[12]</sup>. Feeding of colostrum ensured calf health and survival welfare <sup>[19]</sup> also improvement in milk feeding, amount and kind of feed fed to the calves promotes early weight gain <sup>[9]</sup>. This is in agreement with <sup>[4]</sup> who said that feeding multiple time daily or increased feeding promotes increase in average daily gain in daily heifers. Feeding colostrum is important in providing the mucosal barriers for preventing disease pathogen this is due to the fact serum immunoglobulin GI (IgGI) is associated with the amount of colostrum fed to calves and timing of colostrum ingestion. Where colostrum is not enough, artificial colostrum should be provided to ensure levels of IgGI because reduced level of IgGI leads to increased mortality, lower daily weight gains together with lower milk produced during the first lactation <sup>[10]</sup>.

Dairy calves need to be fed with concentrates to ensure its maximum energy. This practice was not fully practices by the smallholder herd are which could compromise calf performance by reducing average weight daily gains. Starch fermentation in the rumen and growth for calves pre weaned is related to the starter intake so ensuring more concentrates is taken, liquid feeding should be reduced this will maintain weight gains <sup>[2]</sup>.

For sustainability of the herd controlling of disease for the dairy calves is inevitable because it ensures calf survivability. Furthermore disease control is less expensive to disease treatment. The result from the research showed weaker implementation of biosecurity measures in smallholder as opposed to large commercial dairy farmers. Calf performance is in line with controlling of disease incidences since dairy calf disease hinders daily body weight gain. Implementation of the biosecurity measures such as vaccination, deworming and controlling of the ectoparasites will ensure calf performance, this was not the case for the smallholder herds. Vaccination is very important aspect for dairy calves however this seems to be less important for smallholders. These findings are in agreement with previous research showed that dairy producer considered vaccination harmful to calves health <sup>[13]</sup>. The outcome of this attitude is compromising calf's health consequently performance the dairy sector. Prevention reduces calf risks, prevents enteric diseases and minimizes treatment cost in so doing improves calf performance.

### Conclusion

Smallholder dairy producers implement calf housing, feeding and health management practices more poorly than the large commercial producers. In housing, smallholders are poorer in implementing pen disinfection and in feeding they are poorer in implementing recommended colostrums and milk feeding, concentrate supplementation and weaning procedures.

Besides, smallholders more poorly implement recommended health practices, especially vaccination and ecto parasite control. Smallholder dairy producers implement calf housing, feeding and health management practices more poorly than the large commercial producers. In housing, smallholders are poorer in implementing pen disinfection and in feeding they are poorer in implementing recommended colostrums and milk feeding, concentrate supplementation and weaning procedures. Besides, smallholders more poorly implement recommended health practices, especially vaccination and ecto parasite control.

### Recommendations

Smallholder dairy producers need change of attitude towards implementing recommended calf management practices. Implementation of dairy calf management practices will improve the calf welfare consequently dairy sector.

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### Conflict of interest

Authors declare no conflict of interest.

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