

Acquisition and management of Somali camel breed for pastoral resilience within peri-urban Isiolo and Marsabit counties of Northern Kenya

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Abstract

A baseline survey was conducted in Isiolo and Marsabit Counties of northern Kenya to document the acquisition and current management practices of Somali camel keepers. Data collection was done using participatory methodologies i.e. semi-structured interviews and focus group discussions. Data was analysed using descriptive statistics and t-tests respectively.

The results indicated slight differences with Somali camel keepers in Isiolo obtaining breeding stock through market purchase and inheritance, whilst those in Marsabit obtained through market purchase and re-stocking programs. Majority of camel keepers in both Isiolo and Marsabit grazed their camels in shrub lands (65%, n=62; 41%, n=47 respectively) and on plain terrain (73%, n=71; 79%, n=86 respectively) suggesting good level of understanding on the type of vegetation and terrain suitable for Somali camels. Isiolo pastoralists were allowing an extra grazing hour (11.7 hours against 10.7), were watering the Somali camels more frequently especially during dry season (every 5th day against 7th) and were also allowing the calves to suckle for a longer period before beginning to drink water than was the case in Marsabit (5.1 months against 3.8). These management practices are important for commercial camel rearing. In Isiolo, 90% (n=80; N=91) of respondents were feeding their camels with mineral supplement compared to 68% (n=73; N=120) in Marsabit ($\chi^2=14$, $p<0.001$). In Marsabit, 41% (n=44) of respondents had recorded cases of heat repeat compared with 61% (n=54) in Isiolo. About 85% (n=77) of respondents in Isiolo had an average of 2 own breeding bulls compared with 73% (n=78) with an average of 1 in Marsabit. About 87% (n=72) of respondents in Isiolo understood what inbreeding is while 13% (n=11) did not ($\chi^2 = 201$, $p<0.001$). The situation in Marsabit was such that 90% (n=99) of respondents understood inbreeding while 10% (n=11) did not ($\chi^2 = 70$, $p<0.001$). In Isiolo, pastoralists controlled inbreeding in camel herds by exchanging bulls with neighbors (51%, n=76); keeping more than one bull (25%, n=38) and ensuring bull did not mate related females (24%, n=36). Marsabit pastoralists on the other hand controlled inbreeding by exchanging bull with the neighbors (58%, n=52); ensuring bull did not mate related females (27%, n=24) and keeping more than one bull (15%, n=13). Isiolo pastoralists were retiring breeding bulls at 14 ± 6.3 (n=76) years compared with 12.3 ± 6.3 (n=101) in Marsabit. On the other hand, the Isiolo pastoralists were retiring females after 12 ± 7 (n=67) calvings compared to 9 ± 4 (n=62) in Marsabit. Close to 61% (n=52) of Isiolo respondents allowed calves to suckle all the colostrum while in

Marsabit, 50% (n=45) did. When expressed as a percentage of the average number of camels per household (Isiolo =35; Marsabit = 6), the mortality in Isiolo was 3% against 17% in Marsabit. In conclusion, Isiolo pastoralists were doing better with respect to most of the management practices compared to their Marsabit counterparts. The study recommended capacity building in most of management aspects especially in Marsabit where commercial rearing of Somali camels is in the formative stage in order to improve performance and by so doing strengthen resilience of farmers to climate variability.

Key words: *camel performance, capacity building, commercial camel rearing, husbandry practices*

Introduction

Camels are of great socio-economic importance in the lives of pastoral people inhabiting the arid areas of the world (Bahgat 1991). In Kenya, camels have traditionally provided milk, meat, blood for subsistence and have had socio-cultural values among the pastoral communities (Field 2005). Camel rearing is increasingly gaining commercial value in Kenya with a live camel fetching as much as USD. 792 to 891 depending on the size (Personal observation). In 2011, camel milk production in Kenya was estimated as 553 million litres (7% of the national total) worth about KES. 16 billion (Behnke and Muthami 2011) and in the same year, camel meat worth KES. 54 billion was sold. Camels have unique physiological, morphological and anatomical features which makes them the best climate adaptation livestock species in the arid environments (Field 2005). Less water requirements and ability to supply milk throughout the year with or without drought, among other factors make the camel the livestock species of choice in climate adaptation and resilience. The Somali camel breed in particular produce more milk, is heavier and produces more meat, fetch higher price in the market, has higher load and ploughing capacity. Considering that feed resources will become scarcer in future owing to climate change and human activities, it makes sense to keep few but more productive animals and the Somali camel fits this bill in the peri-urban arid areas. This study analyses and documents acquisition and current management practices of Somali camel in Isiolo and Marsabit Counties with a view of benchmarking the project sites ahead of commencement of interventions.

Methodology

The survey was undertaken in the Counties of Isiolo and Marsabit in northern Kenya where a total of 91 and 120 randomly selected respondents were individually interviewed in Isiolo and Marsabit, respectively. A semi-structured questionnaire was used to gather the data from respondents drawn from three purposively selected administrative divisions in Isiolo namely; Ol Donyiro, Isiolo Central, Kina and three in Marsabit namely; Torbi, Maikona and Gadamoji. In each division, a myriad of purposively selected villages with high concentration of Somali camels were sampled and respondents picked at random. The sampling frame was all the pastoralists owning Somali camels in each of the selected villages and the selection ensured representativeness. In total, 14 villages were sampled in Isiolo and 7 in Marsabit. The interviews were conducted by carefully selected and trained enumerators under close supervision by the research team. In addition to the individual interviews, three Focus Group Discussions (FGDs) were held in Isiolo and four in Marsabit. The FGDs involved an average of 10 key informants both men and women to triangulate data gathered through individual interviews but to also collect additional data on environmental issues relevant to camel

production.

Data analysis

The data was entered, cleaned and analyzed using the IBM SPSS statistics version 20 (2011). Descriptive statistics were carried out and test for significance done using chi-square where applicable. For quantitative data, independent samples t-test was undertaken.

Acquisition and Rearing of Somali Camels

In Isiolo, the pastoralists had acquired their Somali camels by buying from the market (68%, n=177), inheritance (24%, n=63), benefiting from a re-stocking program (5%, n=12) and payment for bride price (3%, n=9) compared with purchased from the market (39%, n=50), benefiting from a re-stocking program (36%, n=47), payment of bride price (15%, n=20), loaned by a friend (5%, n=7) and inheritance (5%, n=6) in Marsabit. The responses suggested that Somali camels are currently being promoted in Marsabit County. Number of camels owned by Isiolo and Marsabit pastoralists were as indicated in table 1.

Table 1: Average number of camels per household

Site	Minimum No.	Maximum No.	Mean	SD
Isiolo	1	200	35	44
Marsabit	0	80	6	12

The observed trend on camel numbers can be attributed to the fact that the Somali camels in Isiolo are mainly owned by members of the Somali community reputed to have larger camel herds in Kenya. The very wide range explains the abnormally high standard deviation. In Isiolo, 71% (n=64) had Somali camel breed only compared to 29% (n=26) who also had other camel breeds. This was different from Marsabit where 33% (n=37) kept Somali breed only compared with 68% (n=77) who kept Somali camels alongside other breeds. In Isiolo, camel rearing is more commercialized compared to Marsabit hence higher number of Somali camels which produces more milk and meat (Simpkin et al 1998). There were three main reasons why pastoralists in Isiolo and Marsabit acquired the Somali camels. These were: to increase milk yield of the herd, increase body size of the herd for more meat and high market prices, for breeding, with increasing milk yield of the herd being the most important (56%, n=324 in Isiolo; 52%, n=76 in Marsabit) with the other two ranging between 22% and 26% and not differing much in both sites. Note that this question indeed explains the importance of Somali camel in matters, milk in northern Kenya.

The period over which pastoralists have had Somali camels in Marsabit and Isiolo was as shown in table 2.

Table 2: Period of rearing Somali camels

Site	Minimum No.	Maximum No.	Mean	SD
Isiolo	2	50	16	12
Marsabit	1	65	8	11

The statistics presented in table 2 confirms that most of Isiolo pastoralists have a longer history of rearing Somali camel breed suggesting higher experience than is the case in Marsabit. This finding together with the one showing that a significant number of Marsabit pastoralists have acquired Somali camels through re-stocking programs indicating limited knowledge and management skills for the camel in Marsabit county.

Grazing Vegetation, Terrain, Daily Grazing Hours and Watering Frequency

In both Isiolo and Marsabit, majority of pastoralists grazed their camels in shrub land (65%, n=62; 50%, n=47 respectively) and on plain terrain (73%, n=71; 79%, n=86 respectively). Interestingly, 30% of pastoralists in Marsabit maintained their camels in grasslands compared to a paltry 6% in Isiolo. The rest of pastoralists grazed their camels in dwarf shrub land vegetation in both sites. These results suggest that pastoralists in both sites understood that Somali camels preferred browsing on shrubs and in generally flat terrain, reason being the camel is tall and heavy making it uncomfortable feeding on grass and delicate on rough terrain. The observation regarding Somali camels grazing in grasslands in Marsabit was unique, attributed to fact that in the northern part of Marsabit County where the survey was undertaken, shrubs are scarce and the camels were forced to subsist on what was available i.e. grass and dwarf shrubs. The findings on hours of grazing allowed to Somali camel, watering frequency during dry and wet seasons and, age at which Somali camel calves start taking water in Isiolo and Marsabit were as presented in table 3.

Table 3: Daily grazing hours, watering frequency in dry and wet seasons and age at first watering for Somali camels in Isiolo and Marsabit

Findings	Sites	
	Isiolo (n=43)	Marsabit (n=32)
Grazing hours allowed/day ($\mu \pm SD$)	11.7 \pm 3.8	10.7 \pm 1.9
Watering frequency – dry season (days)	5 \pm 2	7 \pm 4
Watering frequency – wet season (days)	6 \pm 6*	5 \pm 5*
Age at first watering for calves (months)	5.1 \pm 2.5	3.8 \pm 2.3

* High standard deviation can be explained by wide range and small sample size

Important observations from table 3 are; Isiolo pastoralists modified management patterns during the dry season to allow for an extra grazing hour, more frequent watering and longer duration of calf suckling before beginning to drink water than was the case in Marsabit. Longer grazing period and more frequent watering results in higher milk yield which is important for commercial camel rearing. Allowing the calf a longer suckling period enhance calf growth and maturation, fast herd growth which are all critical elements of commercial camel production.

Mineral Supplementation and Milk Yield

In Isiolo, 90% (n=80; N=91) of respondents were feeding their camels with mineral supplement compared to 68% (n=73; N=120) in Marsabit ($\chi^2=14.2$, $p<0.001$). Mineral supplements are critical in milk production (Kuria et.al, 2004a; 2011) and these results clearly indicate Isiolo pastoralists understood this husbandry practice better than their Marsabit counterparts. In Isiolo, 55% (n=46) were feeding their Somali camels on Red Magadi; 17% (n=14) on Macklick and 12% (n=10) on common salt compared with Marsabit where 33% (n=30) fed their Somali camels with Chalbi salt, 32% (n=29) with common salt and 28% (n=25) on Red Magadi. Only two people in Isiolo and 1 in Marsabit fed their camels with a mixture of at least two different types of salts. Important observation on these results is that Somali camel pastoralists in both sites mainly used mineral supplement type that was easily accessible and affordable on their camels, in this case Red Magadi in Isiolo and Chalbi & common salt in Marsabit. Given that most of the commonly used mineral salts in northern Kenya are deficient in key minerals required by camels (Kuria et al 2004a, b), mixtures are recommended. Table 4 shows the amount of milk produced by Somali camels in Isiolo and Marsabit and the average number of milkings.

Table 4: Average daily milk yield and number of milkings in Isiolo and Marsabit

Site	Minimum Amount	Maximum Amount	Mean	SD
	Milk yield (litres)			

Isiolo	2	20	5.1	4.7*(n=6)
Marsabit	1	10	3.4	1.8 (n=43)
		Number of milkings per day		
Isiolo	1	3	2.2**	
Marsabit	1	3	2.0	

* SD was very high due to the wide range but most importantly, the sample was very small i.e. n=6 while N=91

** There is no 0.2 of a milking but an important note in the case of Isiolo is that 38.5% (n=5) were milking thrice a day. This can be attributed to the high level of commercialization compared with Marsabit.

Breeding management

First service

Table 5: Age of Somali camels at first service in Isiolo and Marsabit

Site	Mean (years)	SD
Isiolo (n=86)	4.3	1.5
Marsabit (n=108)	4.5	2.7

Although the two months difference between the sites, Isiolo being lower was not significant, it suggest better management of Somali camels in Isiolo than Marsabit. The difference also has a bearing on herd growth and if not closed, Isiolo Somali camel herds would continue growing at a faster rate than Marsabit.

Cases of heat repeat/conception failure

In Marsabit, 41% (n=44) of respondents have been recording cases of heat repeat compared with 61% (n=54) in Isiolo. This finding is important and may be attributed to fact that Somali camels in Marsabit have access to Chalbi salt from Chalbi desert which is richer in mineral elements compared to the Red Magadi the Somali camels in Isiolo mainly have access to (Kuria 2005). Micro mineral elements especially copper, zinc and selenium are important in animal reproduction and Chalbi salt contain low quantities of copper and zinc while Red Magadi completely lack the two crucial elements.

Breeding bulls

Approximately 85% (n=77) of respondents in Isiolo own an average of two breeding bulls compared with 73% (n=78) with an average of 1 bull in Marsabit. In Isiolo, 51% (n=38) of respondents kept two bulls which they thought were adequate for their camel herd while 24% (n=18) kept the two bulls for purposes of breeding management. In Marsabit on the other hand, 42%, (n=40) kept one bull because they thought was enough for their smaller herds while (38%, n=36) kept the one bull to be able to manage breeding. In Isiolo, a whopping 94% (n=78) of respondents kept Somali bull while the balance either kept Rendille/Gabra or Turkana breed in comparison with Marsabit where 57% (n=51) and 42% (n=38) kept Rendille/Gabbara and Somali bulls, respectively. About 66% (n=51) and 34% (n=26) of respondents in Isiolo kept the Somali bull for increasing milk yield and, adaptability respectively while in Marsabit, 37% (n=36) and 62% (n=60) kept a mixture of Somali and Rendille/Gabbara for increasing milk yield and adaptability, respectively. The small population of Somali breed bulls in Marsabit means it would take the local pastoralists longer to upgrade their indigenous breed for milk. Further, the results of the study clearly indicate that the rearing of nearly 100% of Somali camels in Isiolo and the rush to acquire Somali camel breed in Marsabit was being driven by the desire to get more milk. It is easier and more practical to control inbreeding which normally suppress milk yield with two bulls than one. Using Rendille/Gabbara bull on Somali females like was happening in Marsabit was tantamount to. None beneficial back-crossing and such

pastoralists were not progressing in terms of meeting their objective of increasing milk yield of their camel herds. The Isiolo pastoralists were therefore on track in terms of achieving their objective than were Marsabit pastoralists. The need to have more than one bull which can be used at different times and the need to avoid back-crossing at the early stages of a breeding program are critical capacity building points for the pastoralists in Marsabit and the few using Rendille/Gabbra and Turkana breeds in Isiolo.

About 63% (n=10) of the 14 respondents who did not have a breeding bull in Isiolo said the reason was their camels were few while the remaining either did not have money to buy one or were borrowing from relatives. In Marsabit, 54% (n=23) respondents who did not have a breeding bull said they were not able to buy one while 28% (n=12) did not have own bull as they were borrowing from relatives. The rest felt their camels were few and therefore did not require a bull. It is difficult to rely on someone else's bull since unlike other livestock species, camels are seasonal breeders and all producers require breeding bulls at the same time, yet pastoralists do not like free mixing of herds during breeding season for purposes of breeding management.

Inbreeding and the control

Eighty seven % (n=72) of respondents in Isiolo understood what inbreeding is while 13% (n=11) did not ($\chi^2 = 201, p < 0.001$). The situation in Marsabit was such that 90% (n=99) of respondents understood inbreeding while 10% (n=11) did not ($\chi^2 = 70, p < 0.001$). Regarding interpretation of inbreeding, 87% (n=66) and 13% (n=10) in Isiolo interpreted inbreeding to mean mating of blood related animals and a bull mating his mother, respectively while in Marsabit, 77% (n=76) and 23% (n=23) interpreted inbreeding to mean mating of blood related animals and, a bull mating his mother, respectively. Pastoralists in both sites appear to have similar understanding of inbreeding but it is important to stress during capacity building that blood relationship goes beyond the mother of the bull to include his sisters and daughters. About being aware of problems associated with inbreeding, 81% (n=67) were while 19% (n=16) were not in Isiolo whereas in Marsabit, 77% (n=86) were but 23% (n=26) were not ($\chi^2 = 32.1, p < 0.001$). In Isiolo, 74% (n=50) and 24% (n=16) of those aware of inbreeding related problems indicated that inbreeding reduced livestock productivity due to loss of hybrid vigor and, can lead to massive death in case of calamity, respectively. In Marsabit, 41% (n=43), 34% (n=35) and 25% (n=26) of those aware of inbreeding related problems opined that inbreeding caused malformations in off-springs, reduced productivity due to loss of hybrid vigor and could lead to massive death in the event of a calamity. To be aware of inbreeding related problems is important in controlling this retrogressive practice. There seems to be a reasonable number in both sites lacking in this knowledge and it is important to educate them on the same.

In Isiolo, pastoralists controlled inbreeding in camels herds by exchanging bulls with neighbors (51%, n=76); keeping more than one bull (25%, n=38) and ensuring bull does not mate related females (24%, n=36). Marsabit pastoralists on the other hand controlled inbreeding by exchanging bull with the neighbors (58%, n=52); ensuring bull does not mate related females (27%, n=24) and keeping more than one bull (15%, n=13).

Retiring Breeding bulls and females

Information on the age of retiring a breeding bull is presented in table 6

Table 6: Age of retiring a breeding bull in Isiolo and Marsabit

Site	Mean (years)	SD
Isiolo (n=76)	14.0	6.3

Marsabit (n=101) 12.3 6.3

The data in table 6 shows that the Isiolo pastoralists were retiring breeding bulls late, the recommended age being 12 years (Tura et al 2008) suggesting they were faced with the risk of inbreeding. After retiring a breeding bull, 69% (n=63) and 20% (n=18) of respondents in Isiolo fattened and sold out the bull and, castrated and retained in the herd, respectively. Rest of respondents either exchanged with other livestock or just retained in the herd in uncastrated state. In Marsabit, 47% (n=46), 28% (n=28) and 16% (n=16) castrated and retained retired bull in the herd, fattened and sold out the bull, retained the bull in herd in uncastrated state, respectively. About 73% (n=65) of respondents in Isiolo also retired breeding females while 27% (n=24) did not. In the contrary, 59% (n=62) of respondents in Marsabit retired breeding females while 42% (n=44) did not. These results shows that while pastoralists in both sites retired old breeding bulls in equal measure, a higher proportion of respondents in Marsabit did not retire breeding females. Use of old breeding females and bulls results in weak and vulnerable off-springs with higher mortality levels being reported among such herds (Njanja 2007, Tura et al 2008). It is equally dangerous to retire a bull or a female and retain them in the herd intact since they certainly continue breeding. These malpractices need to be addressed in both Counties through capacity building.

Details of the number of calvings at which breeding females are retired in Isiolo and Marsabit are as indicated in table 7.

Table 7: Number of calving at which breeding females are retired in Isiolo and Marsabit

Site	Mean (years)	SD
Isiolo (n=67)	12	7
Marsabit (n=62)	9	4

The recommended number of calvings at which a female should be retired is six (Tura et al 2008) meaning pastoralists in both sites were going overboard with Isiolo representing the worst case scenario. Exchanging breeding camels retired when too old with other livestock is not good either since such animals have lost nearly all the value. These are anomalies that need to be addressed through capacity building.

Colostrum and Milk Allowance to Calves

Details of how pastoralists utilized colostrum in Isiolo and Marsabit are presented in table 8.

Table 8: Utilization of colostrum in Isiolo and Marsabit

Use	Marsabit		Isiolo	
	Frequency (n)	Varied %	Frequency (n)	Varied %
Allow calves to suckle all	45 (N=120)	50	52 (N=91)	61
Allow calves to suckle a little, strips the rest down	24	26	25	29
Milk and drink	11	12	9	11
Milked and given to other animals	9	9.9	-	-
Strips everything down	2	2.2	-	-
χ^2 , p	(63, p<0.001)		(33, p<0.001)	

Colostrum is important in giving passive immunity to the calves. Based on the data in table 8, a much smaller proportion of respondents in Marsabit allowed the calves to suckle all the colostrum

compared to Isiolo who seems to be doing better. Either way, the knowledge gaps needs to be addressed through capacity building. On the importance of colostrum as perceived by the respondents, 70% (n=64, N=91) and 30% (n=27, N=91) in Isiolo believed colostrum give passive immunity to the calf and, facilitate passing out of meconium/cleans the gut, respectively. In Marsabit, 66% (n=77, N=120) and 31% (n=36, N=120) were of the opinion that colostrum give passive immunity to the calf and, facilitate passing out of meconium/cleans the gut in that order. This particular result confirms that indeed a bigger proportion of Isiolo pastoralists than Marsabit understood colostrum and its importance in camel calves.

A combined majority of respondents in Isiolo (99%, n=82, N=91: $\chi^2=58.3$, $p<0.001$) allowed the calf more milk including 43% (n=36) who allowed the calf access to full under for the first 1-2 months post-partum. This was in comparison with Marsabit where 84% (n=91, N=120) allowed the calf access to two, three or full under with only 13% (n=15) allowing the calf access to full under in the first two months of growth ($\chi^2=107$, $p<0.001$). These findings in essence suggest Isiolo pastoralists took better care of the calf by allowing it more milk which is very important in growth and development in early stages when the calf is not grazing.

Morbidity and mortality of camels

The findings on morbidity and mortality of calves, weaners and mature Somali camels in Isiolo and Marsabit are presented in table 9.

Table 9: Morbidity and mortality of calves < 1year, weaners (1 – 2.5 years) and mature Somali camels between 2014 and 2010 in Isiolo and Marsabit

Age categories	Parameters of interest	Sites	Years									
			2014		2013		2012		2011		2010	
			($\mu\pm$ SE)	Sig.(t)								
Calves < 1 year	Morbidity	Marsabit	1 \pm 0.2	0.08	1 \pm 0.1	<0.001	1 \pm 0.2	0.15	1 \pm 0.2	0.29	1 \pm 0.2	0.16
		Isiolo	2 \pm 0.2	(ns*)	2 \pm 0.2	(s)	1 \pm 0.2	(ns)	2 \pm 0.2	(ns)	1 \pm 0.2	(ns)
	Mortality	Marsabit	1 \pm 0.1	0.27	0	0.72	0	0.14	1 \pm 0.2	0.05	0	0.26
		Isiolo	1 \pm 0.1	(ns)	1 \pm 0.1	(ns)	1 \pm 0.1	(ns)	1 \pm 0.1	(s)	1 \pm 0.2	(ns)
Weaners (1 – 2.5 years)	Morbidity	Marsabit	1 \pm 0.2	0.045	1 \pm 0.1	<0.001	0	<0.001	1 \pm 0.1	0.13	0	0.26
		Isiolo	1 \pm 0.2	(s**)	1 \pm 0.2	(s)	1 \pm 0.2	(s)	1 \pm 0.2	(ns)	1 \pm 0.2	(ns)
	Mortality	Marsabit	0	0.50	0	0.002	0	0.042	0	0.012	0	0.90
		Isiolo	1 \pm 0.1	(ns)	1 \pm 0.1	(s)	1 \pm 0.1	(s)	1 \pm 0.2	(s)	0	(ns)
Mature camels (>2.5 years)	Morbidity	Marsabit	1 \pm 0.2	0.004	1 \pm 0.3	0.15	1 \pm 0.2	<0.001	1 \pm 0.1	0.012	1 \pm 0.2	0.31
		Isiolo	3 \pm 0.4	(s)	2 \pm 0.2	(ns)	2 \pm 0.3	(s)	1 \pm 0.2	(s)	1 \pm 0.2	(ns)
	Mortality	Marsabit	1 \pm 0.1	0.72	1 \pm 0.1	0.60	1 \pm 0.2	0.23	1 \pm 0.2	0.17	0	0.82
		Isiolo	1 \pm 0.1	(ns)	1 \pm 0.1	(ns)	1 \pm 0.1	(ns)	0	(ns)	0	(ns)

*ns – Not significant; **s – Significant

The data in table 9 shows that on the average, two camels were falling sick in a year across all camel classes in Isiolo, different from Marsabit where the average was one. The differences between the sites were significant for some years as denoted by letter 's' under the Sig.(t) column. Average mortality for both sites was 1 except for the weaners in Marsabit where there was no death suggesting some good level of health management by pastoralists leading to recovery of animals which were falling sick. However, the absolute figures may not mean much if not correlated with herd size. Thus,

when expressed as a percentage of the average number of camels per household (Isiolo =35; Marsabit = 6), the mortality in Isiolo was 3% against 17% in Marsabit. The 17% in Marsabit falls outside the acceptable level of 10% calling for intervention through capacity building in matters, health.

Some follow up camel health management related questions were posed to the respondents during FGDs to better understand their challenges in this important subject. Regarding the capacity to diagnose and treat diseases, the combined responses indicated they experienced challenges due to the following reasons: lack of technical knowhow leading to misdiagnosis and wrong treatment; lack of extension services; lack of laboratory facility and personnel; limited knowledge on dosing levels and routes of administration; poor availability and access to drugs; limited knowledge on camel diseases especially among the Borana and Samburu communities who just recently started rearing camels.

On the farmers' experience with ticks and diarrhea in young camel calves, the FGD captured the following, that: camel calf diarrhoea was indeed a common health challenge; pastoralists used human amoxyllin tablets, injectable antibiotics to fight the problem; ticks were also a problem; pastoralists used acaricides as well as avoiding tick infested areas to deal with the problem. Both the individual interviews and FGDs brought out camel health as a major issue and there were clear incidences of drug misuse. These would be important action points during the capacity building activities.

Conclusions

- The results indicate that while Somali camel pastoralists in Isiolo had acquired most of their camels through direct purchase from market and inheritance, those in Marsabit had acquired theirs mainly through purchase from the market and re-stocking programs.
- The respondents in Isiolo had had Somali camels for an average of 16 years compared to 8 for the Marsabit ones.
- Perhaps due to longer experience with the Somali camel breed and fact that the production system is more commercialized, Isiolo pastoralists appeared to be doing better with respect to most of the management practices compared to their Marsabit counterparts.
- The study recommends capacity building on good breeding ratio, supplementation and animal health management, among others, especially in Marsabit where commercial rearing of Somali camel is in the formative stage. This would improve performance of the camels thus strengthening resilience of farmers to climate variability.

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