

## Major Diseases of Camel Calves in Borana of Southern Ethiopia

Bekele Megersa

School of Veterinary Medicine, Hawassa University, P.O. Box 5, Hawassa, Ethiopia

**Abstract:** The study investigates major camel calves' diseases in Borana of southern Ethiopia. A total 551 of calves were seasonally investigated and 663 clinical cases were recorded. The most prevalent diseases were sarcoptic mange (47.9%), ticks (25.6%), contagious skin necrosis (15.8%), abscess (19.2%), contagious ecthyma (9.4), camel pox (6.5%), diarrhea (5.1%) and respiratory infections (4.5%). Seasonal patterns of the diseases showed that mange mite was more prevalent during the dry than wet periods while contagious ecthyma, pox, respiratory infection and dermatophytosis were higher during the wet seasons. Large proportions of calves (over 70%) were also positive for internal parasites including Strongyles, *Strongyloides papillosus*, Monezia and Eimeria species, suggesting the importance of parasitic burden. Deaths have been recorded in 18.1% of the calves with the major causes being septicemic diseases (35%), respiratory infections (22%), sunken eye or *Elgof* (11%) and calf diarrhea (11%). Mortality was significantly higher for wet season than dry period and had decreased with increasing age. Additionally, prevailing tradition of restricting colostrum intake among pastoralists and poor veterinary services might have a putative role on the increased early mortality of camel calves and thus calls for improvements.

**Key words:** Camel Calf • Diseases • Death Losses • Risk Factors • Ethiopia

### INTRODUCTION

Camels are versatile animal species in ensuring food security and fulfilling the livelihood priorities of pastoral households in the arid and semi-arid areas of Ethiopia. They provide pastoral communities with income, food supply, transportation services and other social benefits such as prestige (social status), ceremonial uses, insurance and risk buffering options [1]. Presence of camels in herds was found to improve household food security and dietary intake in the Borana areas [2]. The Boranas who have been cattle pastoralist are increasingly engaged in camel production in response to changing climate and rangeland ecosystem i.e. increased bush encroachment which reduced grazing land for cattle [1]. As a result, the number of households involved in camel production has increased over time. Thus, camels of the study area are managed by pastoralists of different herding experience. For example, Gabra herders have an age old tradition of keeping camels and thus, are endowed with rich indigenous knowledge in camel husbandry. But the Boranas who are late comers into camel business

may have less experience with camels and have inadequate knowledge of camel health care, which is expected to bring about variations in disease occurrences and death losses [3].

Camel calves are the foundation of a camel herd and form the replacement stock without which herd growth is unlikely. Under pastoral management such as Boranas, however, rearing camel calves and ensuring their survival rate to breeding age experience challenges that result in high morbidity and mortality [4, 5]. Shibia *et al.* [6] estimated camel heifer loss to be high (45.5%) and substantially affect replacement stock which comes from own herd. The crude mortalities reported from Ethiopia were 30% by Tuffa and Baars [7] and 45% by Getahun and Kassa [8] from Eastern Ethiopia and 15 to 20% by Megersa *et al.* [3] from Borana area. Similarly, Kaufmann [5] reported mortality rates of 25%, 22% and 27% in Rendille, Gabra and Somali camel calves of Northern Kenya, respectively. Several factors including management, environmental and animal factors may account for such high death rate and deserve an in-depth investigation.

Vast arrays of infectious diseases that are hampering the health of adult camels also affect camel calves [9]. Calf diarrhea, pox, Contagious ecthyma, contagious skin necrosis, pneumonia, mange mite infections and internal parasites are among the major health problems reported elsewhere [10-12]. But some health problems of camels still remain unknown and large scale outbreaks of such mysterious disease have devastated herds of the study area [13]. Understanding the major diseases of camel calves in the study area, causes mortality and associated risk factors may fill some knowledge gaps pertaining to epidemiology of camel calf diseases and thus would contribute to improved control measures. This study therefore investigates major camel calves diseases in Borana of southern Ethiopia and potential risk factors linked to death losses.

## **MATERIALS AND METHODS**

The study was conducted in Yabelo district of Borana zone in southern Ethiopia. The area has semi-arid climate with bimodal rainfall distribution during the major wet season, from mid-March to May and the short rainy season extending from September to November. A cool dry period occurs from June to August while warm dry season extends from December to February [14]. The area is characterized by extensive pastoral production system. Cattle predominate the livestock species biomass followed by small ruminants and camels. Involvement in camel production is on rise due to increased climate variability and rangeland ecosystem changes [2].

A total of 12 villages were randomly selected from the study area with some restrictions depending on accessibility to villages by vehicle and camel population. Subsequently, a total of 70 camel herds were selected and seasonally investigated during the dry period, major rainy and short rainy seasons from December 2007 to November 2008. The dynamic nature of pastoral herds, moving out and in of animals or herds in the study area, indeed made revisiting of the same animal/herd difficult. Hence, newly introduced animals or herds were used to replace those moved out of the selected villages.

Herds were visited and sampled early in the morning before released to the field and samples were processed in the afternoon. Out of 678 camel calves born alive or suckling calves registered during the study period, 551 calves were clinically examined and 362 calves were subjected to fecal examinations. A floatation technique followed by modified McMaster count was made to identify the parasite eggs and protozoal oocyst. Calf mortalities and their causes were recorded during

the field investigations whereas recall method was used for deaths that had occurred between the field observations. Conventional disease investigation methods such as herd health investigation and clinical examinations of individual animals, sample collection and laboratory examination as well as participatory epidemiological study and questionnaire survey were part of the study method.

**Statistical Analysis:** In addition to descriptive summary of the data, further statistical analyses were performed using Stata version 11 (StataCorp, College Station, Texas). Prevalence, crude and age specific mortalities and morbidities were presented as proportion of cases to population at risk. Potential risk factors associated with camel calf mortality were analyzed for herd and animal level variables. Herd level factors such as ethnics (Borana and Gabra), seasons (dry, wet, minor wet), herd size, family size and age of household head were analyzed using binary logistic regression for occurrences of mortality. Analysis of animal level variables such as sex and age of calf and parity of dam were performed using logistic regression analysis.

## **RESULTS**

Results of group discussion showed that diseases (25%) were the major constraints to camel production in the study area followed by poor veterinary services (21%), lack of attention to camels (20%) and feed shortage (12%) associated with limited herd mobility. The Boranas have mentioned lack adequate knowledge in camel husbandry as constraint while Gabra herders emphasized conflict as critical problem for them. Some camel owners reported to prevent early colostrum intake and instead drench the calf with water. Others reported to milk out the colostrum before feeding to calves claiming to reduce scouring. They also pointed out that calves born from some dams were found to repeatedly dying.

Most diseases that affect adult camels were also found to affect calves, with varying degree of occurrence and severity. Table 1 presents important clinical diseases observed among 551 calves examined during the study periods. The most prevalent diseases were sarcoptic mange, tick infestation, contagious skin necrosis, abscess and pox. Seasonal distribution of the diseases showed that mange mite prevalence was higher during the dry period while contagious ecthyma, pox and respiratory infection were more prevalent during the short rainy season compared to other seasons.

Table 1: Seasonal distributions of diseases and health problems in camel calves

Diseases and health problems of camel calves	Dry (n=284)	Major wet (n=169)	Minor wet (n=98)	Overall (n=551)
	No (%)	No (%)	No (%)	No (%)
Mange mite	156 (54.9)	71 (42.0)	37 (37.8)	264 (47.9)
Ticks	74 (26.1)	39 (23.1)	28 (28.6)	141 (25.6)
Contagious skin necrosis	48 (16.9)	25 (14.8)	14 (14.1)	87 (15.8)
Abscess	56 (19.7)	38 (22.5)	12 (12.1)	106 (19.2)
Contagious ecthyma	4 (1.4)	27 (16.0)	21 (21.4)	52 (9.4)
Camel Pox	0	1 (0.6)	35 (35.7)	36 (6.5)
Respiratory infection	4 (1.4)	14 (2.4)	7 (7.1)	25 (4.5)
Calf diarrhea	12 (4.2)	11 (6.5)	5 (5.1)	28 (5.1)
Injury and fracture	2 (0.7)	3 (1.8)	1 (1.0)	6 (1.1)
Septicemia & joint ill	2 (0.7)	5 (3.0)	3 (3.1)	10 (1.8)
Dermatopytosis	9 (3.2)	14 (8.3)	3 (3.0)	26 (4.7)
Sunken eye (Elgof)	15 (5.3)	3 (1.8)	0	18 (3.3)
Eye infections	0	0	5 (5.1)	5 (0.9)
Total morbidity	308 (108.5)	212 (125.4)	143 (145.9)	663 (120.3)

Table 2: Seasonal prevalence of internal parasites among camel calves

Internal parasites	Dry (n=129)	major wet (n=116)	minor wet
	No (%)	No (%)	No (%)
Strongyles	96 (74.4)	80 (69.0)	67 (69.8)
Monezia species	21 (16.3)	25 (21.6)	9 (9.4)
Strongyloids papillosus	17 (13.2)	3 (2.6)	6 (6.3)
Trichuris species	9 (7.0)	5 (4.3)	7 (7.3)
Eimeria (coccidia) species	30 (23.3)	2 (1.7)	3 (3.1)

Sunken eye (Elgof) was commonly observed in advanced ages (above 6 months) and probably associated with internal parasite infection which further exacerbated by malnutrition. Three of such cases had high parasitic load, specifically *Strongyloides papillosus*. *Elgof or Ilqot* is literally “sunken eye” in which affected calves have poor body conditions and depressed supra orbital fossa and eyes sunken into sockets. Respiratory infections and pox have occurred in the form of outbreak and affected all age groups. Clinical observation of septicemia and joint ill *Dhidhiksi* was rather low compared to the emphasis by herders. Herders ranked *Dhidhiksi* as a top disease of calves due to its high fatality and sudden death of calves particularly at early age. *Quanicha* (swollen lymph nodes) was reported as important disease of calves though the disease was not encountered in calves, but in adult animals during the field survey. Swelling of neck region, loss of appetite, diarrhea, reduced urination and sternal recumbency were observed in affected cases. Herders further cited *Quanicha* to be further characterized by reduced urination, so that distended bladder and hemorrhagic lesions were often observed in affected cases at post-mortem.

Similarly, internal parasites were prevailing in calves (over 70%) throughout the seasons (Table 2). Parasitic severity and loads were apparently higher during the dry season than wet periods. Average fecal egg counts were similar across the seasons for strongyles, the major nematodes (906.6 in dry, 1166 in wet and 943.8 minor wet). But fecal egg count was higher for *Strongyloides papillosus* (552.7) during the dry periods than wet periods (19.1), which contributed to an overall increment of parasitic load during the dry period. Oocyst of *Eimeria* species and eggs of *Trichuris* and *Monezia* species were also detected in camel calves of the study area.

Figure 1 shows that septicemia (35%) and respiratory infections (22%) were report to be the most important causes of camel calf mortality. Calves with septicemic infections had clinical manifestations of diarrhea, swellings of joint, collapse and sudden death. Affected calves had hyperemic eyes, swelling of eyelids and cannot stand up. Figure 2 shows comparative age at death, indicating higher proportion of early deaths (over 60% of deaths were below three months).

Table 3 shows herd and animal level factors considered important in affecting deaths among camel calves. Mortality was significantly higher during the

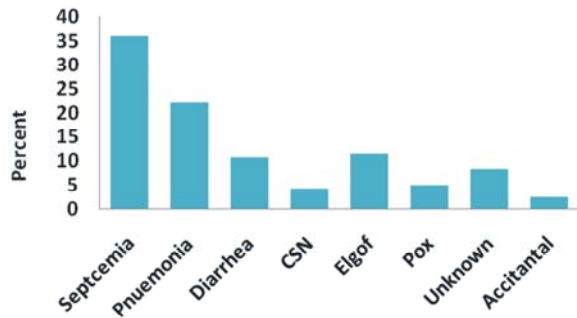


Fig 1: Causes of camel calf mortality during the study period CSN: contagious skin necrosis

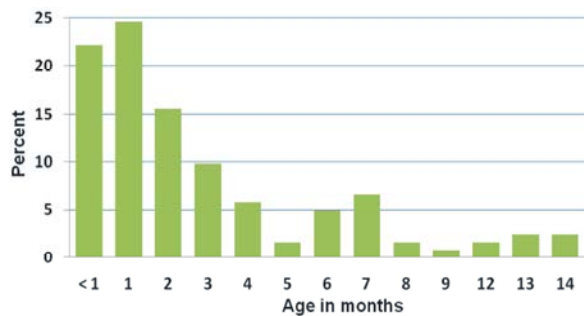


Fig 2: Age specific proportion (percent) of deaths in camel calves

Table 3: Potential risk factors of camel calf mortality

<sup>1</sup> Herd level Variables	Levels	Odd Ratios	P-values
Ethnic	Borana		
	Gabra	0.64	0.210
Season	Dry		
	Major wet	6.08	0.000
	Minor wet	2.31	0.104
Livestock species	2 species		
	> 2 species	1.14	0.709
Herd size,	1.09	0.001	
Family size,	0.96	0.111	
Age of head,	1.02	0.254	
<sup>2</sup> Animal level variables			
Dam parity	1 to 2		
	2 to 4	1.14	0.609
	> 4	1.06	0.841
Sex	male		
	female	0.84	0.402
Age	< 3months		
	≥ 3months	0.23	0.000

<sup>1</sup>herd and <sup>2</sup>animal level variables were analyzed separately using logistic regression, \*indicates continuous variables.

major wet season than dry season and had significantly increased with herd size. The odds of death occurrences were 6.1 and 2.3 times higher during the major and minor wet periods compared to the dry season. Mortality had decreased with increasing age and significantly higher

for calves below three months of age compared to three months and above. The difference between male and female calves was marginal with slightly higher deaths in males(20%) than females (17%). The effects of ethnic group and parity on calf mortality were not significant as expected. Because the Borana herders who had less experience with camel husbandry were expected to experience higher mortality compared to Gabras.

## DISCUSSION

Diseases affecting the integument system of calves such as mange mite, ticks infestation, contagious ecthyma, pox and contagious skin necrosis were quite common in the study area. Specially, mange mite infection due to *Sarcoptes scabiei var cameli* was the major health problem in Borana similar to other reports [9, 15]. Affected calves often had concomitant infection with such diseases as contagious skin necrosis, abscess and contagious ecthyma suggesting the role mange mite in weakening the resistance of calves to infectious diseases. The prevalence and severity of mange mite had increased during the dry period perhaps due to feed shortage which might have reduced the resistance of the animals. Mange infection is a highly contagious disease which spreads from infected adults (mainly lactating dam) to young calves. Herding calves separately and treating infected dams may reduce the disease burden in calves.

Increased occurrence of contagious ecthyma, pox, septicemia and respiratory during wet period may be attributable to favorable environmental conditions for the survival and multiplication of pathogen. Similar pattern of contagious ecthyma occurrence during the rainy season has been reported among camel calves in Sudan [16]. Contagious ecthyma is characterized by quick spread among calves with pustular lesions involving the nostrils, mouth, lips, buccal cavity and swelling of head [9, 16]. Mortality was not observed in affected calves unlike pox, suggesting that pox is more severe than contagious ecthyma. Pox also affects calves and adult animals with lesions affecting most part of the body including belly, face, neck and limbs.

Camel calf diarrhea was a common health problem of calves and characterized by watery diarrhea sometimes reddish and foul smelling, loss of condition, dehydration, dullness and sunken eyes. Diarrhea was reported to be prevalent in 8.0% of calves ranging from one month to one year in Saudi Arabia [12]. A high incidence of calf diarrhea (21.9%) was observed during early summer coinciding with peak of camel calving in Sudan [10].

Calf diarrhea is generally caused by multiple factors including bacterial and viral infections, internal parasites, intake of too much milk and sudden change in feed [9, 17].

Septicemic infection (*Dhidhiksi*) was a major health problem among calves causing early mortality. Affected calves had clinical manifestations of diarrhea, swellings of joint, collapse and death just sometimes after birth. They become weak, hyperemic eyes, swelling of eyelids and cannot stand up. The disease is possibly through navel (umbilical) infections following birth as well as enteric bacterial infections that lead septicemia and early mortality (below three months of age). The disease had increased occurrence during wet seasons. A study by Younan *et al.* [18] showed the greater involvement of *Klebsiella pneumoniae* in septicemia of suckling camel calves in Kenya. Gluecks [11] isolated similar proportion of *Klebsiella*, *Salmonella* and *E. coli* from sick and dead calves.

Respiratory infections, locally known as *Furri*, were common among calves and adult camels and, had occurred during the wet period in the form outbreaks. Agab and Abbas [10] also reported the disease to be a common health problem in Sudanese camels with peak incidence during autumn. Higher incidence of respiratory infection during the wet season may be associated with change of climatic condition from warm dry to wet, predisposing factors being draft, cold, rain, poor nutrition as well as long trekking during migration that may distress the animals and increase their susceptibility [10, 19]. The causes of camel respiratory infections are generally complex. A more fatal and highly contagious respiratory disease syndrome has occurred in 2007 as a large scale outbreak during wet season in Borana areas [13].

Little is known about diseases known by local vernacular names such as *Quanicha* (swollen lymph node) and *Elgof* (sunken eye). Available literature regards *Quanicha* as hemorrhagic septicemia either due to pasteurellosis [20] or *Bacillus cerus* intoxication [15]. Gluecks *et al.* [20] used different vernacular names including “Khanid” (Rendille), “Quarir” (Somali), “Quandich” (Gabra) or “Quandho” (Borana) for hemorrhagic septicemia of camels in Kenya. Kachhawaha *et al.* [21] reported similar clinical manifestations such as fever, depression, edematous swelling of the throat and neck region in camels affected by pasteurellosis.

Sunken eye was more common in advanced ages (above 6 months) and probably associated with internal parasitic burden which might be exacerbated by feed shortage. The fact that some of the *Elgof* cases had high

parasitic load (particularly, *Strongyloides papillosus*) and increased prevalence of the disease during dry period may imply that the disease might be a joint effect of parasite and malnutrition. Likewise, a high prevalence (over 70%) of internal parasites throughout the seasons in sub-sampled calves (Table 2) suggesting the importance of parasitic burden on health and performance of calves. Higher parasitic severity and loads during the dry than wet periods, contradicts the finding of Mohamed and his colleagues [22] who reported higher prevalence (83.33 % vs. 59.26 %) and parasitic burden (2908 vs. 919 EPG count) during the rainy season than the dry season. Hence, high parasitic burden call for instituting strategic deworming of camel calves.

The overall crude mortality of 18.1% is similar to the previous mortality report of 15 to 20% from Borana area [3]. Contrasting figures on mortalities have been reported in camel calves of different age ranges which indeed make comparison difficult. The crude mortality for Ethiopian camel herds were 30% by Tuffa and Baars [7] and 45% by Getahun and Kassa [8]. Kaufmann [5] also reported mortality of 25%, 22% and 27% in Rendille, Gabra and Somali camel calves of Northern Kenya, respectively. This suggests high loss of calf crops that vitally affect the replacement stock in particular and herd growth in general [6]. The major causes of calf mortality observed in this study are similar to reports elsewhere [23, 24]. In a study by Ahmed and Hegde [24], sunken eye (12%), camel pox (7%), pneumonia (7%), contagious ecthyma (6.9%) and contagious necrotic skin (4.6%) were reported as causes of mortality. Farah *et al.* [25] reported diarrhea to be the major cause of death (73%) in Somalia. A high morbidity (80%) and mortality (12.7%) due to camel pox in calves less than one year have been reported by Mahmoud *et al.* [26] from Egypt.

The higher early mortality (below three months of age) substantiates age as the major risk factor associated with calf mortality (Table 2). Age specific proportion of deaths has showed a decreasing trend with increasing age except for age at 6-7 months (Figure 3). This could be either due to weaning age that increases mortality or by chance. A study by Ahmed and Hegde [24] showed high calf mortality (about 50%) during the first few weeks following birth with subsequent declining trend i.e. 30% during 90 days and 19% thereafter. Similarly, Musa *et al.* [23] reported occurrences of all calf mortality during the first postpartum month in Omani camel herds. But the effects of dam parity and calf sex on calf mortality were not significant in the analysis, though male calves (20%) had slightly higher mortality than females (17%).

Association of increased herd sizes with death occurrences in camel herds could be linked to increased number of susceptible calves in large herds. A significantly higher mortality rate during the wet than the dry season may coincide with higher prevalence of infectious diseases during wet seasons.

Discussions with camel keepers suggested that some herders of the study area either avoid early colostrum ingestion or milk out the first colostrum similar to observations elsewhere [25, 27]. Inadequate colostrum intake and failure of passive transfer have been linked to early calf mortality in pastoral camels. Kamber *et al.* [28] reported that 39% of the studied calves had below 4g/litre of serum colostrum concentration, which can be a critical value for in cattle and horse. The author thus, attributed early mortalities in camel calves to low colostrum intake during the first 24 hours of life. So, it is important to note that adequate colostrum intake during the first 24 hours is vital for survival of calves. If calves are not able to suckle within 12 hours after birth, assistance from the herdsman is required. Additionally, sufficient milk intake during the first three months of age (before the calf starts grazing) is also very decisive for the wellbeing and survival of calves. Schwartz *et al.* [4] noted that malnutrition due to competition of human beings and camel calves for milk has been the major cause of mortality during the dry year in Kenya.

In general, the study revealed a high morbidity and mortality of camel calf which indeed hinders production performance and herd growth of pastoral camels. A number of diseases have been observed during the field survey, suggesting the need for improved veterinary service to camels. Loss of a camel calf is noticeably very costly due to long calving intervals and gestation period of camels and reduced milk off-take that affects household food security. Improving camel calf management is vitally important for the Borana herders who are recently shifting from cattle to camel production. Hence, implementing feasible intervention measures such improved veterinary services during high disease occurrences and ensuring timely intake of adequate colostrums help to minimize disease prevalence and high death losses.

#### ACKNOWLEDGEMENT

This paper is part of the research project on “a study of major camel diseases in the Borana of southern Ethiopia, which was financially supported by the Drylands Coordination Group (DCG) of Norway. The willingness of camel owners to cooperate and

share their knowledge on camel husbandry and effective field works of veterinary assistants deserve much gratitude.

#### REFERENCES

1. Megersa, B., A. Markemann, A. Angassa, J.O. Ogotu, H.P. Piepho and A. Valle Zárate, 2014. Livestock diversification: an adaptive strategy to climate and rangeland ecosystem changes in southern Ethiopia. *Human ecology*, 42(4): 509-520.
2. Megersa, B., A. Markemann, A. Angassa and A. Valle Zárate, 2014. The role of livestock diversification in ensuring household food security under a changing climate in Borana, Ethiopia. *Food Security*, 6: 15-28.
3. Megersa, B., A. Regassa, B. Kumsa and F. Abunna, 2008. Performance of camels (*Camelus dromedarius*) kept by pastoralists with different degree of experience in camel keeping in Borana, Southern Ethiopia. *Animal Science Journal*, 79(4): 534-541.
4. Schwartz, H.J., R. Dolan and A.J. Wilson, 1983. Camel Production in Kenya and its constraints. I. Productivity. *Tropical Animal Health and Production*, 15: 169-178.
5. Kaufmann, B.A., 2005. Reproductive performance of camels (*Camelus dromedarius*) under pastoral management and its influence on herd development. *Livestock Production Science*, 92: 17-29.
6. Shibia, M.G., G. Owuor and B.O. Bebe, 2013. Evaluation of losses of replacement heifers in pastoral and peri-urban camel herds in semi-arid northern Kenya. *Pastoralism*, 3: 23.
7. Tuffa, K. and R.M.T. Baars, 1998. Milk production performance of pastorally managed camels in Eastern Ethiopia. In: *Proceedings of the Ethiopian Society of Animal Production*. Addis Ababa, Ethiopia, pp: 184-193.
8. Getahun, T. and B. Kassa, 2002. Camel Husbandry Practices in Eastern Ethiopia: The Case of Jijiga and Shinile Zones. *Nomadic Peoples*, 6: 158.
9. Abbas, B. and O. H. Omer, 2005. Review of infectious diseases of the camel. *Veterinary Bulletin* 75, 1N-16N.
10. Agab, H. and B. Abbas, 1999. Epidemiological studies on camel diseases in eastern Sudan. *World Animal Review*, 92: 42-51.
11. Gluecks, I.V., 2007. The Prevalence of Bacterial and Protozoal Intestinal Pathogens in Suckling Camel Calves in Northern Kenya. PhD Dissertation, Institute for Animal and Environmental Hygiene, Free University of Berlin, Germany.

12. Al-Ruwaili, M.A., O.M. Khalil and S.A. Selim, 2012. Viral and bacterial infections associated with camel (*Camelus dromedarius*) calf diarrhea in North Province, Saudi Arabia. *Saudi Journal of Biological Sciences*, 19: 35-41.
13. Megersa, B., D. Biffa, F. Abunna, A. Regassa, J. Bohlin and E. Skjerve, 2012. Epidemic characterization and modeling with-in-herd transmission dynamics of an emerging trans-boundary camel disease epidemic in Borana, Ethiopia. *Tropical Animal Health and Production*, 44: 1643-1651.
14. Coppock, D.L., 1994. The Borena Plateau of Southern Ethiopia: Synthesis of the Pastoral Research, Development and Change, 1980-1991. ILRI, Addis Ababa, Ethiopia.
15. Wernery, U. and O.R. Kaaden, 2002. *Infectious Diseases of Camelids*. 2nd edition. Blackwell Science, Berlin.
16. Khalafalla, A.I., 2000. Camel contagious ecthyma: Risks in young calves. *Revue Élev. Méd. vét. Pays trop.*, 53(2): 173-176.
17. Mohammed, M.E.H., C.A. Hart and O.R. Kaaden, 2013. Viruses and bacteria associated with neonatal calf diarrhea in eastern Sudan. *Emirate Journal of Agricultural Science*, 15: 56-62.
18. Younan, M., I.V. Glücks, R. Podschun and S. Bornstein, 2013. *Klebsiella pneumoniae*: A commensal and cause of septicemia in camel calves (*Camelus dromedarius*). *Journal of Camelid Science*, 6: 90-99.
19. Schwartz, H.Z. and M. Dioli, 1992. The one-humped camel in Eastern Africa. A pictorial guide to diseases, health care and management. Verlag Josef Margaf, Schonwald Druck, Berlin, pp: 282.
20. Gluecks, I.V., M. Younan, S. Maloo, C. Ewers, A. Bethe, D. Kehara and J. Kimari, 2009. Combination of participatory approaches and molecular diagnostics to investigate the epidemiology of hemorrhagic septicemia in camels (*Camelus dromedarius*). Conference of the International Society of Camelids Research and Development (ISOCARD), Djerba, Tunisia, 10<sup>th</sup> -14<sup>th</sup> March, 2009.
21. Kachhawaha, S., D.S. Meena, M.K. Srivastava, D. Singh, R.K. Tanwar, A.P. Singh and J.P. Kachhawa, 2012. An outbreak of Pneumonic pasteurellosis in camels (*Camelus dromedarius*) clinical behavior, meteorological variables, management and control. *Veterinary Practitioner*, 13(2): 218-222.
22. Mohamed, Y.K., B.C. Merga and Y.M. Yesihak, 2013. Influence of internal and external parasites on pre-and-post weaning performance of camel calves at Errer Valley, Eastern Ethiopia. *International Journal of Research and Reviews in Pharmacy and Applied science*, 3(4): 566-577.
23. Musa, Salim, B.E., M.A. Abu and M.T. Samra, 2000. Omani camel calves in a traditional management system. *Revue Élev. Méd. vét. Pays trop.*, 53(2): 209- 212.
24. Ahmed, S.M. and B.P. Hegde, 2007. Preliminary study on the major important camel calf diseases and other factors causing calf mortality in the Somali Regional state of Ethiopia. Conference on Recent trends in Camelids research and Future strategies for saving Camels", Rajasthan, India, 16-17 February 2007, pp: 3- 41.
25. Farah, Z., M. Mollet, M. Younan and R. Dahir, 2007. Camel dairy in Somalia: Limiting factors and development potential. *Livestock Science*, 110: 187-191.
26. Mahmoud, M.A., T.R. Abo-Elnag, W.A. Osman, A.I. Bassiouny and A.S. Goda, 2012. Epidemiology and Characterization of Camel Poxvirus in Northwest Costal Area of Egypt. *Global Veterinaria*, 9(6): 738-744.
27. Kuria, S.G., I. Tura, S. Amboga, H.K. Walaga and J. Lesuper, 2011. The current status of camel (*Camelus dromedarius*) calf management among pastoral communities of northern Kenya. *Livestock Research for Rural Development*, 23(7).
28. Kamber, R., Z. Farah, P. Rusch and M. Hassig, 2001. Studies on the supply of immunoglobulin G to newborn camel calves (*Camelus dromedarius*). *Journal of dairy research*, 68: 1-7.