



Peste des petits ruminants in Kenya; Pastoralist knowledge of the disease in goats in Samburu and Baringo Counties

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Abstract

Peste des Petits Ruminants disease outbreak was reported in Turkana County in Kenya in 2007. This was the first time PPR had clinically been reported in Kenya. Peste des Petits Ruminants disease was then assumed to have only infected Turkana County. Participatory disease surveillance was carried out in 2007 in Samburu and Baringo Counties which neighbour Turkana County to establish whether PPR was present in these counties and to describe the local pastoralist's perceptions of PPR. The methods used were semi-structured interviews, participatory disease risk mapping, matrix scoring and proportional piling techniques in 13 focus group discussions each with an average of nine herders from 13 villages. Twenty four serum samples for antibody analysis with competitive ELISA were collected from goat herds of respondent villages. By the time of the study, no PPR vaccination had ever been carried in Samburu and Baringo counties. The results from this study indicated that the four pastoral ethnic communities interviewed in Samburu and Baringo counties had previous experience with PPR like disease. There was local knowledge of a PPR-like disease in each pastoral community and their descriptions of this syndrome closely matched textbook descriptions of PPR. Suspected cases of PPR were observed in the study areas. 10 out of 24 serum samples collected from suspected cases had PPR antibodies, and positive samples were found in each County. Based on the local characterizations of PPR, the presence of PPR antibodies in the serum samples and clinical observation of suspected PPR cases, the study concluded that PPR was occurring in Samburu and Baringo counties of Kenya, in areas that neighboured Turkana. The morbidity and mortality in these other Counties may have been less dramatic and therefore not reached the attention of the veterinary department.

Keywords: Participatory disease surveillance; Peste des petit ruminants; Kenya

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Introduction

A Peste des petit ruminants (PPR) is an acute or sub-acute febrile highly contagious and often fatal disease of sheep, goats and wild small ruminants (Braide, 1981). The disease was first described in Cote d' Ivoire, West Africa by Gargadennec and Lalanne in 1942. The disease is caused by Peste des petit ruminants virus (PPRV) which belongs to the genus *Morbillivirus* in the family *Paramyxoviridae* and has only one serotype with four distinct lineages (Barrett et al., 1993). Peste des petit ruminants has been described

in the Middle East, South Asia, China and Africa. In Africa, PPR is found in North, East, West and Central Africa. In Kenya, PPR was first suspected in 1992 (FAO, 2008) with further serological reports being made by Wamwayi et al. (1995). Peste des petits ruminants was reported in Turkana, Kenya by 2006 but it was not confirmed and officially reported to OIE until 2007 (Promed, 2007). Other participatory epidemiological studies have indicated that PPR disease was first seen in small ruminant herds by Turkana herders of North Turkana in 2005 (Bett et al., 2008). Prior to the 2007 PPR disease reports in Turkana, little

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was known of the disease presence and its epidemiology in Kenya, and this situation has not changed as there is a scarcity of published information about the PPR disease situation in Kenya. Following the confirmed PPR outbreaks in Turkana, vaccination against PPR was carried out throughout Turkana district in 2007 in an effort to stop the disease from spreading to southern regions of Kenya.

This participatory disease surveillance study was carried out in the Counties of Samburu and Baringo which neighbour Turkana County with the aim of determining the presence of PPR and routes of introduction based on the knowledge and experience of the local communities. At the time of this study, no previous study or report of PPR had been made to veterinary authorities from these two counties.

Materials and Methods

Study area

The study was carried out in Samburu North, Pokot East and Baringo Central districts in July 2007. The three districts are located in former central region of former Rift Valley province. Samburu North district in Samburu County has an estimated 95% of the population in the district practising pastoralism as way of life. The Samburu North district is located in lowland range is composed of grassland with dwarf shrub and deciduous bushes. The rainfall pattern of the district falls into two distinct seasons, long rains between March and May; and short rains in October to November. Baringo central and Pokot East districts have over 90% of the population in the districts practising pastoralism as way of life. The two districts are characterized by arid and semi-arid districts vegetation mainly grassland with dwarfs shrubs and deciduous bushes. The two districts experience two rainfall seasons of long rains from March to May and the short rains from October to November.

Selection of study sites

The study sites were selected purposively based on information gathered during a key informant discussion about prevalent goat diseases and areas suspected to have goats with signs similar to the PPR clinical case definition. The case definition was described without telling the key informants the disease it was associated with to prevent bias. The clinical case definition for PPR in goats was based on the stomatitis pneumo-enteritis syndrome (Hamdy, 1976), acute disease, ocular discharge, nasal discharge, diarrhea, depression, emaciation and death (Braide 1981; Kahn et al., 2005). The key informants were requested to identify villages where disease fitting this case definition had been observed or heard about disease with these signs in the last one year. Thirteen locations were identified and

these were selected as study sites. The five study sites in Samburu North district were in Nyiro and Baragoi divisions in the following locations; Kuwamaparan, Lolgetei, Suiyan, Katongur Parkati and Marti. In Baringo central district the five study sites were located in Marigat division, Kapkuikui, Lobo and Mokowo villages Mukutani division, Mosuro and Kiserian villages. The three study sites in Pokot East district were in Monte Division, Nginyang village; Nginyang division, Chesitet and Chesakam villages.

Coordinates of study sites were collected using GARMIN eTrex Legend personal navigator global positioning system (Garmin international, Inc. Olathe, Kansas. USA).

Data collection

Before any interview was conducted, the research team introduced the purpose of the research to the local chiefs and elders and requested consent to work with the local community. To avoid bias, the disease of interest, PPR, was not mentioned during the introduction or at any time during the interviews or focus group discussion.

Key informant interviews

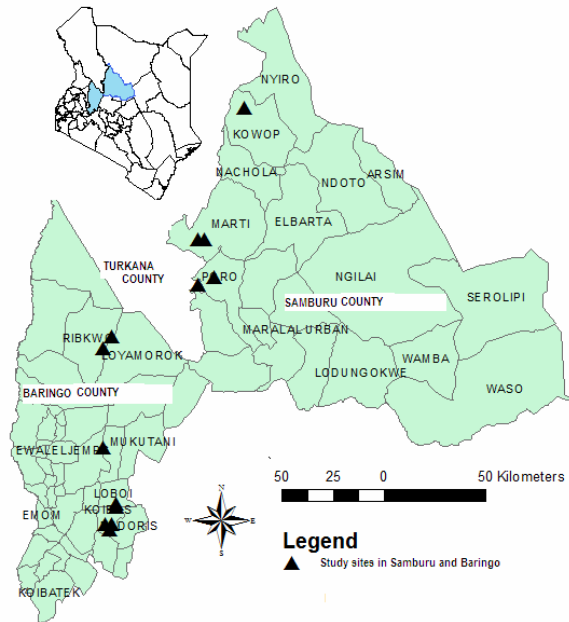
Key informant interviews were conducted with local administrators, local elders, opinion and spiritual leaders at divisional headquarters level. These leaders provided guidance that ensured amiable meetings. The key informants provided a general overview of the disease situation their villages including control interventions in animal health undertaken by government and development partners (Catley, 2005).

Focus group discussions

Focused group discussion using participatory epidemiology (PE) tools were used in this participatory disease surveillance (PDS) (Catley, 2002; Jost et al., 2007) to collect data. The focus groups had on average 9 respondents most of whom were men although in some villages the respondents included women. A total of 13 focus group discussions (FGD) were conducted in the four different ethnic groups. Five FGDs were conducted with Turkana ethnic group in Samburu North district, three were conducted in Baringo central with Tugen ethnic group, two were conducted with Ilchamus ethnic group and three were conducted in Pokot East district with Pokot ethnic group. During the FGD a variety of discussion techniques were employed to encourage participation and allow triangulation of responses. The tools used were semi-structured interviews, matrix scoring, participatory mapping, proportional piling and direct observation (Mariner and Paskin, 2000; Catley, 2005). The FGD were conducted in the local language and an interpreter from the local community assisted the researchers in translating the discussion into English.

Table 1: Characteristics of Samburu and Baringo counties (ALRMP, 2009; KNBS 2010)

County	District	Area sq km	Ambient temperatures °C		Average Annual rainfall in mm	Human population	Sheep and Goat population
			Min	Max			
Samburu	Samburu North	7,035	21	35	500	59,801	413,403
Baringo	Pokot East	4,517	18	35	600	133,189	1,854,742
	Baringo central	2,478	18	35	600	162,351	241,112

**Fig. 1: Map of Samburu and Baringo Counties highlighting study sites**

Semi-structured interviews

Semi-structured interviews (SSI) were based on a checklist of open-ended questions that guided the FGD (Jost et al., 2007). The SSI checklist was pretested and adjusted prior to carrying out the detailed study. The respondents were initially asked to name and describe the key diseases of goats prevalent in their area as well as the circumstances under which these diseases occur. This provided a list of goat diseases or syndromes, clinical and pathological signs as well as risk factors for each disease based on their own experiences and previous observations.

Matrix scoring

Disease matrix scoring was conducted on the ground. The x-axis represented the diseases prioritized by the respondents as key priority disease in the community. However, one of the diseases was the syndrome described by the respondents that fitted the case definition for PPR.

The y-axis represented the five to six clinical signs including three to four clinical signs from the clinical case definition of PPR and one or two clinical signs from one of the five priority diseases. Each clinical sign was allocated 30 counters and the respondents were

asked to divide the counters amongst the six diseases depending on how much the clinical sign was manifested and identified with the disease (Catley, 2001). The more a clinical sign was observed in a disease the more counters the disease was allocated. For each ethnic group the matrices were standardized, but they differed between the ethnic groups. The disease matrix scoring provided visual characterization of the local PPR-like syndrome and also triangulated disease information generated by the respondents through semi-structured interviews. Local characterization of disease clinical signs helped the researchers to establish the likely diagnosis of the local diseases.

Proportional piling

Proportional piling was used to estimate the relative disease prevalence and mortality in the goat herds in the preceding 12 month period as described by (Catley 2005; Ameri et al., 2009). A pile of 100 croton seeds was used to depict the village herd of goats. The respondent group was asked to remember the last one year and divide the pile of croton seed into two piles, one pile representing all goats that got sick last year while the other represented healthy goats last year. The pile representing sick goats were further subdivided by informants among the prioritised goat diseases including a category "other" to represent other unmentioned diseases. The Turkana and Ilchamus had a list of six priority diseases plus the 'other diseases' category. The Tugen had a list of eight priority diseases plus 'other diseases'. The Pokot had seven priority diseases plus the 'other disease' category.

Participatory risk maps

Participatory mapping was done one in each of the community interviewed. The map was drawn on a clear area of ground then copied onto paper (Catley, 2005; Jost et al., 2007; Ameri et al., 2009). The key features mapped were major urban centres and social amenities, administrative areas, settlements, grazing areas, water points (dams, rivers and boreholes), location of disease occurrence and entry points of diseases as well as livestock markets and routes.

Clinical observation

Goats belonging to the respondents and presented for various ailments were clinically examined by the study team. General observation of the herds was done

Table 2: Summary of matrix scoring results with Turkana herds

Clinical sign	Disease (<i>local disease name</i>)					
	<i>Loukoi</i> (CCPP)	<i>Lotai</i> (Pneumonia)	<i>Ekitowo</i> (PPR Depression)	<i>Loutogonyen/ Lokio</i> (PPR)	<i>Lorenmarteny</i> (Enterotoxemia)	<i>Kinyoot</i> (Helminthiasis)
Acute (W=0.783***)	13 (9-22)	2 (0-5)	0 (0-3)	3 (0-8)	8 (5-14)	0 (0-2)
Nasal discharge (W=0.584*)	0 (0-14)	0 (0-6)	4 (4-19)	9 (7-23)	0 (0-0)	3 (0-13)
Ocular discharge (W=0.765**)	0 (0-10)	0 (0-0)	5 (2-8)	23 (20-25)	0 (0-5)	0 (0-2)
Coughing (W=0.868***)	14 (3-18)	11 (9-27)	0 (0-3)	0 (0-4)	0 (0-0)	0 (0-0)
Diarrhea (W=0.871***)	0 (0-0)	0 (0-0)	0 (0-2)	12 (6-18)	2 (0-6)	13 (10-22)
Emaciation (W=0.658**)	0 (0-2)	10 (3-19)	0 (0-7)	4 (3-19)	0 (0-0)	8 (0-22)

n=5; W=Kendall's Coefficient of Concordance (*P<0.05;**P<0.01; ***P<0.001). The number outside the parenthesis is the median scores for each clinical sign for each disease as scored by informants during the matrix scoring. 10th and 90th percentile limits are shown parentheses. Turkana disease names in italics.

Table 3: Summary of matrix scoring results with Tugen herds

Clinical signs	Disease							
	<i>Chebuon</i> (CCPP)	<i>Simbrion</i> (Mange)	<i>Kiburume</i> (Orf)	<i>Kipkeita</i> (Enteritis)	<i>Kiptil</i> (Enterotoxemia)	<i>Kuosu</i> (Abortions)	<i>Ng'oing'oik</i> (Goat pox)	<i>Seberok</i> (Kipkermet PPR)
Abortion (W=0.986**)	7 (7-9)	0 (0-0)	10 (4-10)	0 (0-0)	0 (0-0)	21 (15-29)	0 (0-0)	0 (0-0)
Nasal discharge (W=1**)	12 (8-15)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	28 (25-32)
Eye Discharge (W=0.624)	4 (0-17)	0 (0-16)	8 (0-11)	0 (0-0)	0 (0-0)	0 (0-1)	0 (0-0)	19 (15-29)
Coughing (W=0.815*)	17 (10-29)	0 (0-0)	4 (0-7)	0 (0-0)	0 (0-8)	0 (0-5)	0 (0-0)	16 (7-17)
Diarrhoea (W=824*)	6 (3-9)	0 (0-0)	0 (0-0)	24 (24-24)	10 (0-10)	0 (0-0)	0 (0-0)	3 (0-7)
Hair loss (W=0.770*)	0 (0-0)	22 (21-24)	7 (6-16)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-12)	0 (0-12)

n=3; W=Kendall's Coefficient of Concordance (*P<0.05;**P<0.01; ***P<0.001). The number outside the parenthesis is the median scores for each clinical sign for each disease as scored by informants during the matrix scoring. 10th and 90th percentiles limits are shown parentheses. Tugen disease names in italics.

Table 4: Summary of matrix scoring results with Pokot herds

Clinical signs	Disease						
	<i>Loukoi</i> (CCPP)	<i>Kipkoloswo</i> (Babesiosis)	<i>Megeyon</i> (Goat pox)	<i>Chepngerat</i> (Enteritis)	<i>Keital kisen</i> (Enterotoxemia)	<i>Tionbomu</i> (Helminthiasis)	<i>Kipkonyin</i> (PPR)
Acute (W=0.559)	7 (7-8)	3 (2-6)	3 (3-5)	5 (2-5)	9 (4-9)	6 (6-6)	2 (2-5)
Nasal discharge (W=0.589)	13 (11-23)	5 (0-13)	0 (0-7)	0 (0-0)	0 (0-9)	0 (0-0)	7 (0-15)
Eye Discharge (W=0.328)	0 (0-14)	8 (0-12)	0 (0-7)	0 (0-0)	0 (0-0)	10 (0-23)	11 (0-20)
Coughing (W=0.785*)	15 (13-17)	0 (0-0)	0 (0-6)	0 (0-0)	0 (0-0)	8 (4-12)	0 (0-7)
Diarrhoea (W=0.792*)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-6)	14 (13-16)	10 (6-21)	7 (0-12)
Emaciation (W=0.466)	0 (0-3)	2 (0-10)	0 (0-12)	0(0-0)	13 (9-13)	10 (0-12)	9 (0-12)

n=3; W=Kendall's Coefficient of Concordance (*P<0.05;**P<0.01; ***P<0.001). The number outside the parenthesis is the median scores for each clinical sign for each disease as scored by informants during the matrix scoring. 10th and 90th percentile limits are shown parentheses. Pokot disease names in italics.

Table 5: Summary of matrix scoring results with Ilchamus herds

Clinical signs	Disease					
	<i>Ilkipei</i> (CBPP)	<i>Nkula Naanyokie</i> (Babesiosis/ PPR [#])	<i>Ipepedo</i> (Mange)	<i>Sirr</i> (Acute helminthiasis)	<i>Lbuss</i> (Enterotoxemia)	<i>Ntumwai</i> (Helminthiasis)
Acute (W=0.900)	9.5 (9-10)	4 (3-5)	6.5 (6-7)	5 (4-6)	2 (2-2)	3 (3-3)
Nasal discharge (W=550)	11 (11-11)	11.5 (4-19)	4.5 (0-9)	0(0-0)	0 (0-0)	3 (0-6)
Eye Discharge (W=0.629)	12.5 (8-17)	14 (6-22)	0 (0-0)	0 (0-0)	0 (0-0)	3.5 (0-7)
Coughing (W=0.371)	18 (6-30)	0 (0-0)	0 (0-0)	4.5 (0-9)	0 (0-0)	7.5 (0-15)
Diarrhea (W=0.186)	5.5 (0-11)	9.5 (0-19)	2 (0-4)	0 (0-0)	0 (0-0)	13 (0-26)

n=2; W=Kendall's Coefficient of Concordance (*P<0.05;**P<0.01;***P<0.001). The numbers outside the parenthesis are the median scores for each clinical sign for each disease as scored by informants during the matrix scoring. 10th and 90th percentile limits are shown parentheses. Ilchamus disease names in italics. Babesiosis/PPR[#] this was observed to be a mixed infection of Babesiosis and PPR. No asterix on the W figures means P>0.05

Table 6: Summary estimated incidence and mortality of PPR in Samburu and Baringo Counties

PPR morbidity & Mortality	Samburu County		Baringo County	
	Samburu North Turkana n=5	Pokot East	Baringo Central	
		Pokot n=3	Tugen n=3	Ilchamus n=2
Estimated Incidence of all diseases	58.6 ±13.7	82.7±17	73.0±12.7	79.0±12.7
Estimated Incidence of PPR	15.8±4.7	10.0±2.6	10.0±5.2	9.0±5.7
Estimated Mortality of PPR	7.6±3.0	5.7±1.5	4.3±3.5	2.5±0.7
PPR case fatality	47.4±7.3	56.8±8.7	40.5±23	31.5±11.2

Results obtained from proportional piling technique for morbidity and mortality

Table 7: Serum samples collected and analysed for PPR antibodies

County	District	village	Number of Sera Samples	Number of positive Results
Samburu	Samburu North	Marti	1	1
	Samburu North	Parkati	3	0
Baringo	Baringo Central	Mosuro	2	0
	Baringo Central	Loboi	4	1
	Baringo Central	Kapkuikui	3	3
	Baringo Central	Kiserian	4	1
	East Pokot	Chesakam	7	4
	Total		24	10

Ten of the 24 samples analyzed were positive for PPR antibodies. One sample was from Samburu, five from Baringo and four from East Pokot districts.

by walking amongst grazing goats. This helped to cross-check the information provided during the interview and scoring exercises.

Laboratory sample collection

Samples were collected purposively from village herds that had cases suspected to be PPR. Blood was collected by jugular-vein puncture using venoject needles and vacutainer tubes (Venoject, UK). The blood was left to clot overnight in boxes. The serum was decanted into sterile 2 ml cryovials and stored at -20°C. The laboratory results were used to triangulate information collected from the focus group discussion. A total of 24 serum samples were collected and sent to Government of Kenya Central Veterinary laboratories at Kabete for cELISA analysis for presence of antibodies against PPR disease (Libeau et al., 1995).

Data management and analysis

The data was entered and cleaned in Microsoft Excel (Microsoft Corp., Redmond, WA). It was then exported to SPSS (2008) statistical software version 17.0 (IBM Corp., Armonk, NY) for analysis. Descriptive analysis generated descriptive statistics, frequencies, means and median score estimation. Agreement between matrix scoring by different informant groups was assessed using Kendall's coefficient of concordance (W), (SPSS, 2008)

Results

The study was conducted with four pastoral ethnic communities; Turkana, Pokot, Tugen and Ilchamus. The results are presented separately for each ethnic pastoral community.

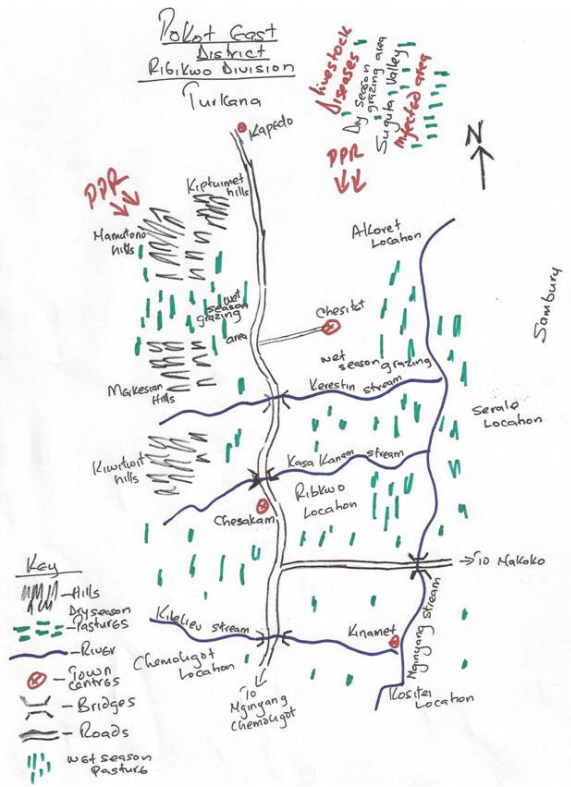


Fig. 2: Participatory map of Chesakam and Chesitet in Villages in Pokot East district Baringo County

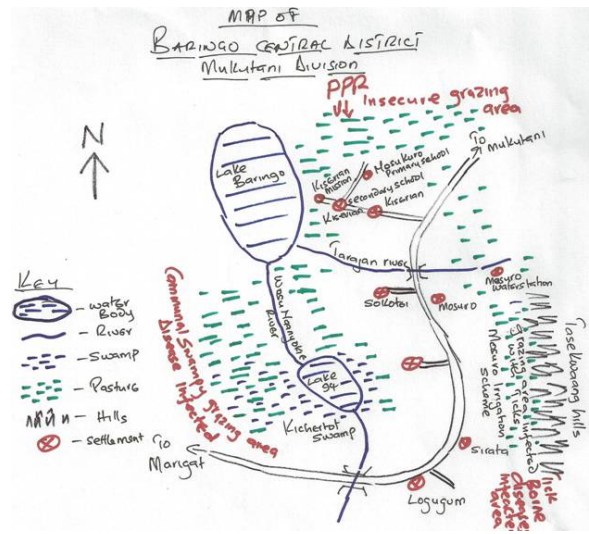


Fig. 4: Participatory map of Mosuro and Kiserian in Baringo Central district

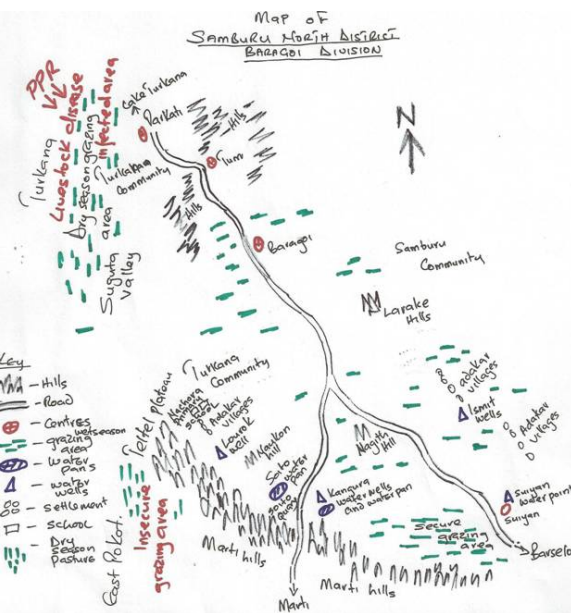


Fig. 3: Participatory map of Suiyan and Soito villages in Samburu North district

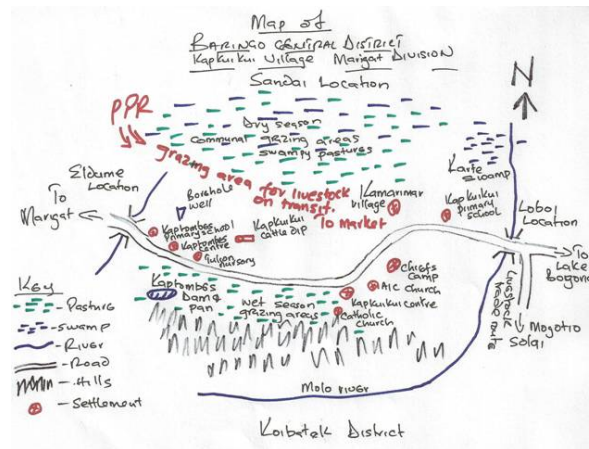


Fig. 5: Participatory map of Kapkuikui village of Marigat Division

Pastoral respondents knowledge and characterization of PPR

During the focused group discussion held in Samburu North district the Turkana informants identified *Lokio*, *Loutogonyen* and *Ekitowo* as relatively new disease syndromes that had infected their herds of goats. *Lokio* means lacrimation, *Loutogonyen* means sunken eyes following dehydration due to diarrhea and the two names were used for describing rinderpest in Turkana (Ohta, 1984; IIRR and ITDG, 1996) while *Ekitowo* means depression in Turkana. The Turkana informants highlighted that Turkana community named the disease from the most prominent disease sign that presented. It was observed that *Ekitowo* and *Lokio/Loutogonyen* were described as two separate diseases though they shared some clinical signs. The informants described *Lokio/Loutogonyen* as a disease

that presented the following signs lacrimation, diarrhoea, nasal discharge, emaciation and death. The disease affected all ages in large numbers with high mortality mainly in young kids. *Ekitowo* was described as having depression, lacrimation, nasal discharge, some diarrhoea, emaciation and death. The two disease syndromes *Ekitowo* and *Lokio/Loutogonyen* did not respond to treatment given to sick goats. From the clinical case definition the two syndromes were different presentations of PPR like disease. The respondent groups agreed that the source of the disease was communal grazing areas in neighbouring Suguta valley and the goats bought from Kulal and Kerio markets in Turkana County. The Turkana respondent groups characterised clinical signs of PPR (*Ekitowo/Lokio/Loutogonyen*) in matrix scoring with high level of agreement ($W=0.584-0.871$) as disease that was moderately acute presenting diarrhoea, emaciation, nasal and ocular discharge.

The Tugen respondents from Baringo district in Baringo County identified *Kipkermet* as a new syndrome in their goats. However respondents from Lobo village informed that syndrome was also known as *Seberék*. *Kipkermet* means lacrimation while *Seberék* means profuse nasal discharge. It was also established through probing of the informants that the disease was relatively new having been introduced into the division through livestock raids that involved the Pokot and Ilchamus one year prior to this study that is 2006. The *Kipkermet/Seberék syndrome* was described as having nasal discharge that blocked nostrils leading to difficult breathing, diarrhoea and lacrimation that resulted in matted eyelids. It was also mentioned that PPR like syndrome affected and killed many goats and did not respond to treatment. Local disease characterization showed high level of agreement between the Tugen respondent groups ($W=0.624-1.000$) for the disease signs.

Pokot respondents from Pokot East district in Baringo County identified *Kipkonyin* as the PPR like syndrome. *Kipkonyin* was described as an acute new disease which caused eye discharge, nasal discharge, diarrhoea, salivation, foul mouth and death. The disease was said to have been in the community's goat herds one year prior to the study in 2006. The respondents associated the source of the disease to be from goats sourced through trade and raids from north and west of the districts. Matrix scoring exercise showed low to moderate level of agreement for disease signs ($W=0.328-0.792$) between the Pokot respondents groups.

Respondents from Ilchamus community from Baringo district Baringo County did not name any new disease in their goat herds. However they stated that the clinical signs of goat diseases were changing. The respondents explained that Babesiosis (*Nakula*

Naanyokie which means red urine in Ilchamus) a common disease in their locality was exhibiting other unfamiliar signs of diarrhoea, and nasal and ocular discharges. The respondents displayed their knowledge of babesiosis as a disease that affects goats with signs of red urine, shivering, and weakness, animal isolates itself from others, has ticks attached on the body and finally dies. However the new clinical signs may indicate a possible mixed infection of babesiosis and PPR in the goats. The respondents mentioned that the syndrome that had mixed signs of red urine, diarrhoea, nasal and ocular discharge did not respond to treatment and was prevalent in goats sourced from northern part of the County. A local characterization of diseases showed that the informant groups moderately agreed on assigning clinical signs to diseases as depicted on table 4 but with no marked significance.

Estimated incidence and mortality of PPR

The overall annual incidence of all types of diseases in Baringo County was higher than in Samburu County though not significant. The communities in Baringo County highlighted that there was a continuous occurrence of infectious diseases mainly CCPP, tick-borne diseases, helminthiasis, enterotoxaemia and recently PPR like disease. However the relative incidence of PPR was higher in Samburu County.

Participatory risk maps

Respondents from each of the communities interviewed drew a disease risk map representing their area. The risk maps included grazing areas, watering points, disease infected areas and other social infrastructure.

The informants of Pokot community from Chesakam village were in agreement that most of the goat diseases including PPR like disease (*Kipkonyin*) disease, came from the north in Suguta valley where Turkana, Samburu and Pokot communities met for grazing and communal salt licks during the dry season. The diseases became established in southern settlements when communities returned to southern wet season grazing areas.

Turkana informants from Samburu indicated in the map that the disease PPR like disease (*Lokio*) had originated from the North West in Suguta valley, where goats were taken for salt licks. It was also mentioned that goat bought from various markets in the west such Kerio, Kulal and Lake Turkana were the source of infection with PPR.

Informants from Ilchamus community in Mosuro village indicated in their map that the swampy communal grazing areas were source of goat diseases. When the goats migrated to the highlands in the east, they got infested with ticks which were partly to blame for the disease PPR Babesiosis (*Nkula Naanyokie*)

mixed infection. *Nkula Naanyokie* was mentioned as a disease with additional new clinical signs barely in two years and became apparent during insecure period when community migrated southwards.

Respondents from Baringo, Kapkuikui village indicated on the map that a major livestock trade route existed towards Mogotio and Solai. The respondents mentioned that *Kipkerment* (PPR-like disease) could have been brought by traders' goats in transit from the north heading for final destination markets in Mogotio and Solai. However the respondent mentioned infected goats bought from markets in the north being introduced into the communal grazing areas thus spreading the disease. The swampy communal grazing areas were blamed for being sources of various ailments in goats.



Fig. 6: PPR suspect case presented for clinical examination at Kiserian village in Baringo District.

Clinical case observation

Clinical case examination and herd observation in the study locations was carried out. In Lolgetei village Nyiro Division, Kawap location, Samburu North district some four goats were presented to surveillance team and they exhibited emaciation, soiled behind with diarrhoea, matted eye lids at the inner eye canthus and, blocked nostrils. The respondents described the condition as *Lokio* and mentioned that the condition had affected many other goats in the locality. Most of the affected goats had always died.

In Kapkuikui and Sokotek villages in Marigat division, respondents presented six goats which were alleged sick with *Kipkermet / seberok*. The goats' exhibited nasal discharge which had matted blocked the nostrils, there were dried lacrimation that matted in the inner canthus, emaciation and soiling was found in the behind of the kids. The condition was described as affecting various herds of goats in the locality. The condition did not respond to treatment thus the affected goats end up dying.

In Sokotei and Kiserian villages Mkutani division four goats were presented with ocular-nasal discharges, depression, (see Figure 6) emaciation, abortion and soiled behind in the kids. The affected goats died.

Serology samples analysis

Of the 24 Serum samples submitted to the Central Veterinary Laboratories, were analysed.

Discussion

The four pastoral ethnic communities interviewed in the study all reported having had an experience with a new disease syndrome in their goat herds that had become apparent a year to the study. The local names of PPR reflected the main clinical signs observed in the sick goats except for the Ilchamus community. In some communities PPR had more than one name in different localities based on the most common clinical sign. In Turkana community residing in Samburu County, PPR was given three names *Lokio*, meaning lacrimation, *Loutogonyen* meaning sunken eyes due to dehydration and *Ekitowo* meaning sickly and depressed. The diseases *Lokio* and *Loutogonyen* in Turkana have previously been associated with rinderpest, a disease of cattle that is similar in clinical manifestation to PPR (Ohta, 1984). Among the Tugen community, PPR was given two names *Kipkermet* meaning lacrimation and *Seberok* meaning profuse nasal discharge. In the Pokot community PPR was locally named *Kipkonyin* meaning lacrimation. Ilchamus community did not have a new name for the disease syndrome. The herders from all the respondents' ethnic communities described PPR disease features that matched the PPR clinical case definition and the disease epidemiological characteristics (Kahn et al., 2005). The local perceptions of PPR disease based on clinical signs, clinical case observation and its epidemiology were consistent with published PPR descriptions. In situations where the PPR disease was not described as a separate new disease as in case of Ilchamus community, there was agreement that the change observed in babesiosis disease was new to their area. Herders from Ilchamus community had observed goats with babesiosis exhibiting extra signs of diarrhea, eye and nasal discharge; and thus they took it to be a variant of babesiosis (*Nkula Naanyokie*). Further enquiry through disease characterization matrix scoring of clinical signs, epidemiological mapping, clinical case observation and antibody serological test revealed that syndrome experienced by Ilchamus herders was mixed infection of PPR and Babesiosis. Turkana herders' description of the epidemiology of PPR emphasized that the disease came with goats that grazed in Suguta valley in Turkana County where all livestock from Pokot,

Turkana and Samburu grazed for communal salt licks and dry season pastures. Other source of the disease mentioned by Turkana herders was goat sourced from markets in Kulal and Kerio on Turkana County. Similar observations were made by Tugen community respondent who observed that PPR disease came with goats sourced by livestock traders and got mixed with local goats in grazing areas before finally being disposed to final markets. The Pokot and Ilchamus concurred by pointing the goats sourced (through raiding, markets or cultural ceremonial giving) from north direction as the source of the PPR like disease. The participatory risk maps drawn by respondents confirmed that PPR risk areas were communal grazing areas as well as the northern grazing regions bordering Turkana County where most livestock meet during dry season grazing.

The respondents also talked of the PPR disease mainly attacking young goats in most cases and had been in existence for one year by the time of this study. The estimated incidence of PPR ranged from 9% to 15.8% while estimated mortality ranged from 2.5% to 7.6%. No vaccinations of PPR had been done in the two Counties of Baringo and Samburu prior to the study. These study observations point to a situation where PPR may have been in existence within the goat herds for some time to a point where the adult goats had survived previous PPR outbreaks and acquired immunity as shown from serum samples collected and tested positive for PPR antibodies. The communities' assertion that PPR disease was now more apparent in young goats; and probably in those that had just lost maternal immunity than in older goats (Awa *et al.*, 2003) suggest endemic situation of PPR in the two Counties. This may explain the overall estimated incidence and mortality of PPR that was below 20% for this study.

Conclusion

At the time of the study, PPR was considered a new disease in Kenya and only found in Turkana County alone where dramatic outbreaks had been reported 2006. The neighboring counties to Turkana County are inhabited by pastoralist communities who share grazing in times of drought and at other times they raid each other's livestock, yet they had not officially reported PPR presence. Through participatory disease surveillance this study was proactive in establishing that communities in Samburu and Baringo Counties had previous experience with PPR that had not been reported to veterinary services. This study further establishes the need to carry out comprehensive disease surveillance that adopts both qualitative and quantitative disease surveillance methods in effort to increase chances of detecting disease within communities.

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