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Knowledge, attitude and practices of livestock farmers on Peste Des Petitis Ruminants (PPR) in Moroto district, Uganda

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Abstract

A Participatory Disease Search (PDS) was conducted in subcounties of Katikekile, Nadunget, Tapac, Rupa and Moroto Municipality in Moroto district with the aim of investigating the prevalence of PPR, possible risk factors for its spread and level of PPR awareness among livestock keepers. PDS tools, including key informant interviews, Focus Group Discussions (FGDs) and proportional piling were employed. Semi-structured interviews were administered to key informants, including Veterinary experts in Moroto district and Informed Community Leaders. A total of 8 to 14 livestock keepers were selected in each of the 5 Subcounties visited and subjected to FGDs. Proportional piling was employed to facilitate livestock keepers to assess the prevalence and severity of PPR during FGDs. Livestock keeping communities interviewed were aware of PPR and assessed its prevalence to be 21.6% and its severity to be 32.4%, hence confirming its importance and presence. In addition, livestock keeping communities were aware of other related diseases such as Contagious Caprine Pleuropneumonia (CCPP), Anaplasmosis, East Coast fever (ECF), Heartwater, Foot and Mouth Disease (FMD), Mange, Helminths, Tick infestation and Footrot. The prevalence of PPR was assessed to be 36% in Katikekile Subcounty, 24% in Nadunget Subcounty, 14% in Tapac Subcounty, 20% in Rupa Subcounty, and 20% in Moroto Municipality. Corresponding PPR disease severity was assessed at 10% in Katikekile Subcounty, 34% in Nadunget Subcounty, 8% in Tapac Subcounty, 54% in Rupa Subcounty, and 50% in Moroto Municipality. Laboratory testing for PPR using the competitive ELISA revealed 9 out of 29 (31%) seropositive goats and 1 out of 3 (33%) seropositive sheep. Despite the limited sample size, these findings confirmed and corroborated the views of livestock keeping communities. Key informants and livestock farmers further confirmed that practices such as routine annual migration of livestock from different districts in Karamoja sub-region; mixing of herds; introduction of new animals in the herd during frequent raids; social traditions and the livestock management of the ethnic groups living in Karamoja largely contributed to the spread of PPR. In conclusion, further routine surveillance through PDS was necessary to allow effective prevention and control of PPR outbreaks in Moroto district.

Keywords: PDS, PPR, Moroto district

1. Introduction

The livestock population in Uganda is estimated to be 11.4 million cattle, 12.5 million goats, 3.4 million sheep, 3.2 million pigs, 37.4 million chickens, 1.5 million ducks and 0.35 million turkeys. Disease is considered the main constraint to the livestock sub sector causing an estimated annual loss of about 86.3 million US\$. Among the most important diseases affecting livestock in Uganda are Transboundary Animal Diseases (TADs), such as Peste Des Petitis Ruminants.

Peste Des Petitis Ruminants, popularly known as “goat plague”, is a widespread, virulent, and devastating disease of small ruminants. PPR is caused by a morbillivirus, which belongs to the Paramyxovirus family. It is characterized by sudden onset of depression, fever, discharges from the eyes and nose, sores in the mouth, laboured breathing and cough, foul-smelling diarrhea and death. Mortality rates of 50 to 80 percent occur in infected flocks while morbidity rates normally range between 80 and 90 percent. PPR is closely related to the rinderpest virus of cattle and buffaloes. It is a contagious disease that spreads by contact with infected materials causing severe illnesses, deaths and reductions in animal production (Taylor, 2015) ^[1].

PPR is considered as one of the topmost damaging animal diseases in Africa, the Middle East and Asia. It is considered one of the priority diseases indicated in the FAO-OIE Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) and eradication. A global OIE/FAO meeting held in Abidjan, Cote Du Ivoire (31st March – 2nd April, 2015) declared PPR to be eradicated worldwide by 2030 (FAO/OIE (2015) [2]. At Continental level, 25 Member States in Africa including Uganda reported PPR in recent reports (PAARYB, 2014) [3]. PPR was first diagnosed and confirmed in Uganda in 2007 in the Karamoja region (Mulindwa *et al.* 2011) [15]. During which time, PPR outbreaks were only confined to Karamoja region in the districts of Abim, Kotido, Moroto, Nakapiripirit, and Kaabong that lie on the North Eastern border with Kenya and South Sudan. Over 500,000 goats and sheep died within a very short time, leading to mortality losses of approximately US\$14,285,000 and severe negative economic, food security and livelihood impacts (FAO, 2019) [5]. Since then, outbreaks have occurred in other districts, namely Kiruhura, Bushenyi, Kasese, Mbarara and Buliisa including Hoima (Ruhwezi *et al.*, 2010) [4]. In the recent past, Uganda reported two outbreaks of PPR with 773 cases and 90 deaths in 2014 (PAARYB, 2014) [3].

PPR has a major impact on the already vulnerable lives of pastoral communities given the adverse global climatic changes that lead to more frequent droughts in such areas forcing herders to search far and wide for water and pasture thus spreading the disease further. Thus, effective control of PPR is anticipated to reduce illnesses and deaths of small ruminants hence promoting more production, food security, household income and trade, nationally and internationally. The Ministry of Agriculture, Animal Industry & Fisheries (MAAIF) in Uganda together with other development partners such as Food and Agricultural Organization (FAO) have been vaccinating goats and sheep against the disease, however, the funding is never adequate (FAO, 2019)⁵. Despite previous PPR control attempts in Uganda, disease foci are still entrenched in Karamoja pastoral areas and in

other parts of Uganda. Over 5,000,000 goats and sheep are estimated to be at risk and outbreaks can occur any time (FAO, 2019) [5]. However, the risk factors responsible for the occurrence and spread of the disease in Moroto district in Karamoja are yet to be well understood and the level of awareness amongst the livestock owners is not known. Against this background, a Participatory PPR Search was conducted in Moroto district in order to adequately inform an appropriate prevention and control strategy.

2. Materials and Methods

2.1 Study area

The study was conducted in Moroto district that borders Kotido district in the North, Kenya border in the East, Napak district in the West and Nakapiripirit and Amudat districts in the South (see Figure 1). Moroto district has an estimated livestock population of 350,000 cattle, 380,000 goats and 400,000 sheep (OCHA, 2009) [6]. Karamoja has bi-modal variable rainfall patterns with an average of 500-600 milliliters of rainfall per year (Gradé, Tabutic & Van Dammea, 2009) [7]. The rainy season that is approximately restricted to four months usually begins in late March or early April and continues until late September or early October. It has daily mean temperatures ranging between 17 °C (minimum) and 32 °C (maximum). The region has a semi-arid to arid agroecological environment and is prone to cyclical droughts that may last 5-15 months. The terrain is flat grassland with a few scattered thorn bushes and trees, except along the seasonal rivers, where thickets and patches of gallery forest are found (Gradé, Tabutic & Van Dammea, 2009) [7]. Karamojong live a Pastoralist lifestyle keeping Zebu cattle, goats and sheep.

2.2 Selection of study sites

The District Veterinary Officer selected the study sites using a risk-based approach according to the history of PPR outbreaks. Katikekile, Nadunget, Tapak and Rupa subcounties and Moroto Municipality were selected for the study.

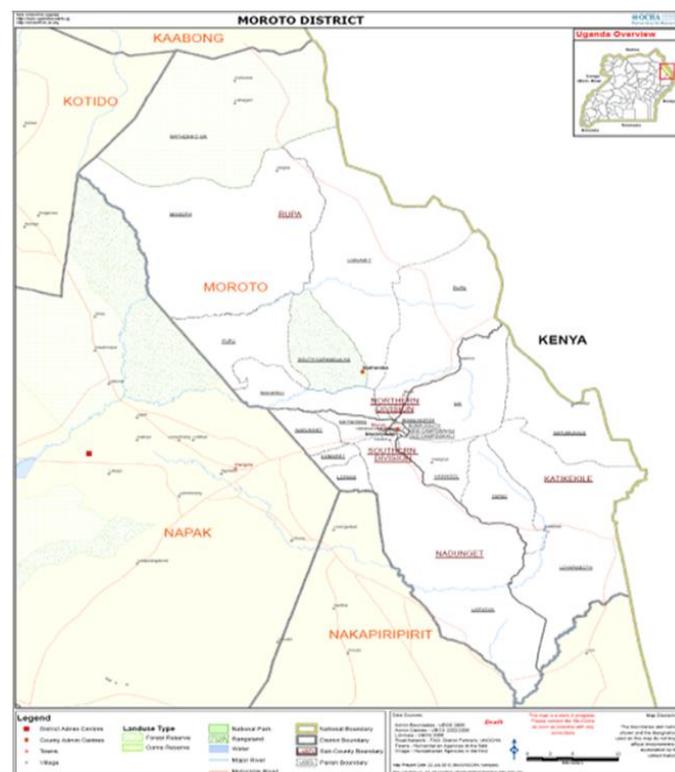


Fig 1: A map of Moroto District depicting study sites

2.3 Study design

The study design employed a Participatory Disease Search/Participatory Epidemiology (PDS/PE) approach (Catley & Berhanu, 2003; CAHO, 2011)^[8, 9]. A team of from the Ministry of Agriculture, Animal Industry and Fisheries conducted Semi-structured interviews of key informants and focus groups of livestock keepers. The key informants interviewed included, The District Marketing and Production Officer, the District Veterinary Officer, Veterinary Officers and Informed Community Leaders. Available secondary data was as well collected. For purposes of clear understanding during interviews, a case definition for PPR had the following major clinical signs: sudden onset of depression, fever, discharges from the eyes and nose, sores in the mouth, laboured breathing and cough, foul-smelling diarrhea and death.

2.4 Participatory Disease Search tools

One focus group discussion was conducted in each of the selected areas: Katikekile, Nadunget, Tapak, Rupa and Moroto Municipality. Focus group discussions were very crucial in assessing knowledge of communities on existing common diseases including PPR and the severity of diseases. In addition, it was important in assessing the community awareness on PPR presence. Proportional piling was employed to assess the prevalence of diseases including PPR.

The checklist for a Participatory PPR Disease Search elaborated the following: (1) Avoiding mentioning PPR before the livestock owners do; (2) Introducing the appraisal team as an animal health appraisal; (3) Identifying the respondents and establishing if they are livestock owners; (4) Establishing their main herding locations (mapping); (5) Identifying the current small ruminant disease problems in their flocks in the Subcounties. If sudden onset of depression, fever, discharges from the eyes and nose, sores in the mouth, laboured breathing and cough, foul-smelling diarrhea and death were mentioned, then PPR was explored for in details; (6) Identifying current small ruminant problems in Moroto district; (7) Historically, what the most

important disease problems of small ruminant were in Moroto district- Invariably PPR was expected to be mentioned in the response to this question if the livestock owners had experienced outbreaks then; (8) Whether they had personally seen PPR cases in their lifetimes and what it looked like; (9) When was the last time their small ruminants were affected by PPR and where came from; and (10) What conditions favored occurrence of PPR outbreaks. In addition, further probing questions were added to cross-check reports made in other interviews, coupled with defining climatic patterns and uncontrolled movement of small ruminants which did affect the epidemiology of PPR, or that contrasted outbreaks with previous outbreaks in regard to the severity of disease.

2.5 Data storage and analysis

The data obtained from the participatory methods was entered and stored in Microsoft Excel software. Descriptive statistics was used for data analysis.

3. Results

According to secondary data sources, routine annual migration of livestock from different districts in Karamoja sub-region; mixing of herds; introduction of new animals in the herd during frequent raids; social traditions and the livestock management of the ethnic groups living in Karamoja are the critical risk factors influencing the spread of PPR.

Prevalence levels of common disease conditions affecting livestock in Moroto district were assessed by livestock keepers in selected subcounties through proportional piling as presented in Table 1. Generally, livestock keepers were aware of PPR (21.4%), Contagious Caprine Pleuropneumoni (CCPP) (22.6%), Anaplasmosis (18.6%), East Coast Fever (ECF) (9%), Heartwater (4.6%), Foot and Mouth Disease (FMD) (4.4%), Mange (3.2%), Helminths (3%), Tick infestation (2.6%) and Footrot (1%). PPR had the highest overall of 21.4%, followed by CCPP (22.6%) and anaplasmosis (18.6%).

Table 1: Prevalence of disease conditions in Moroto District as per community perception through proportional piling

Disease/ conditions	Subcounties in Moroto District											
	Katikekile		Nadunget		Tapak		Rupa		Moroto Municipality		Overall mean	
	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank
PPR (<i>Lowulitokeny</i>)	34	1	23	1	14	2	18	3	18	3	21.4	2.0
Anaplasmosis (<i>Lopid</i>)	9	4	22	2	6	5	28	1	28	1	18.6	2.6
CCPP (<i>Loukoi</i>)	22	2	18	4	47	1	13	4	13	4	22.6	3.0
ECF (<i>Lokit</i>)	0	7	0	8	3	7	21	2	21	2	9.0	5.2
Helminths (<i>Ngikuru</i>)	0	7	5	5	10	4	0	6	0	6	3.0	5.6
Mange (<i>Emitina</i>)	7	5	3	7	6	5	0	6	0	6	3.2	5.8
FMD (<i>Ejaa</i>)	1	6	21	3	0	9	0	6	0	6	4.4	6
Ticks (<i>Ngimandang</i>)	0	7	0	8	13	3	0	6	0	6	2.6	6
Heartwater (<i>Loukou</i>)	23	3	0	8	0	9	0	6	0	6	4.6	6.4
Footrot (<i>Ebaibai</i>)	0	7	5	5	0	9	0	6	0	6	1	6.6

Disease severity as observed by livestock keepers across subcounties visited in Moroto district as assessed through proportional piling is presented in Table 2. Livestock keepers were aware of the severity of different diseases.

CCPP was the most severe disease (33.6), followed by PPR (32.4%), and then anaplasmosis (19.4%), Tick infestation (5.2%), Mange (2.4%), Heartwater (2.4%), ECF (1.8%), FMD (1.8%), Footrot (1.8%) and Helminths (0.8%).

Table 2: Level of disease severity as per the perception of communities in Moroto district through proportional piling

Disease severity	Subcounties in Moroto district											
	Katikekile		Nadunget		Tapak		Rupa		Moroto Municipality		Overall mean	
	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank
CCPP (<i>Loukoi</i>)	46	1	27	2	57	1	19	3	19	3	33.6	2.0
PPR (<i>Louruto</i>)	10	4	35	1	9	3	54	1	54	1	32.4	2.0
Anaplasmosis (<i>Lopid</i>)	17	2	23	3	3	5	27	2	27	2	19.4	2.8
Ticks (<i>Ngimandang</i>)	0	7	0	7	26	2	0	4	0	4	5.2	4.8
Mange (<i>Emitina</i>)	9	5	0	7	3	5	0	4	0	4	2.4	5.0
Heartwater (<i>Loukou</i>)	11	3	0	7	1	7	0	4	0	4	2.4	5.0
ECF (<i>Lokit</i>)	0	7	0	7	8	4	0	4	0	4	1.6	5.2
FMD (<i>Ejota</i>)	3	6	5	5	0	8	0	4	0	4	1.6	5.4
Footrot (<i>Ebaibai</i>)	0	7	8	4	0	8	0	4	0	4	1.6	5.4
Helminths (<i>Ngikuru</i>)	0	7	4	6	0	8	0	4	0	4	0.8	5.8

Laboratory testing of 32 samples collected from 29 goats and 3 sheep using the PPR competitive ELISA at the National Disease Diagnostic and Epidemiology Centre (NADDEC), equally confirmed seropositivity to PPR of goats and sheep in Moroto District. Of the 29 goats sampled, 9 (31%) were seropositive and of the 3 sheep sampled, 1 (33%) were seropositive.

Figure 2 is a pie chart showing prevalence levels of the common disease conditions affecting livestock in Katikekile Subcounty. PPR had the highest prevalence (36%), followed by Heartwater (24%) and then CCPP (23%).

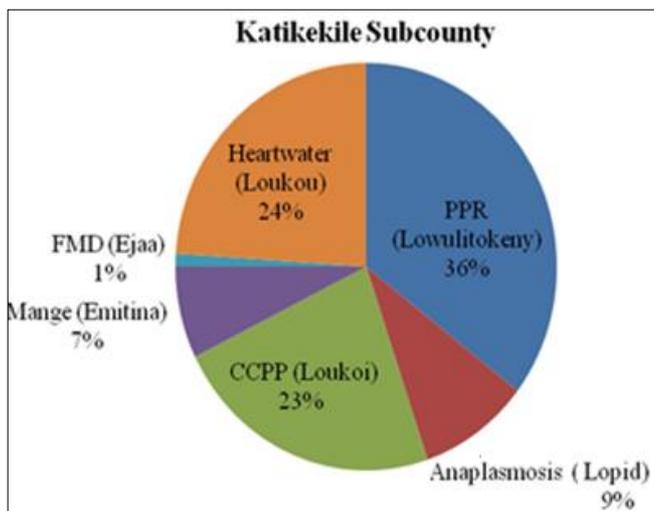


Fig 2: Prevalence of disease conditions among livestock in Katikekile Subcounty in Moroto District as per Community perceptions through proportional piling

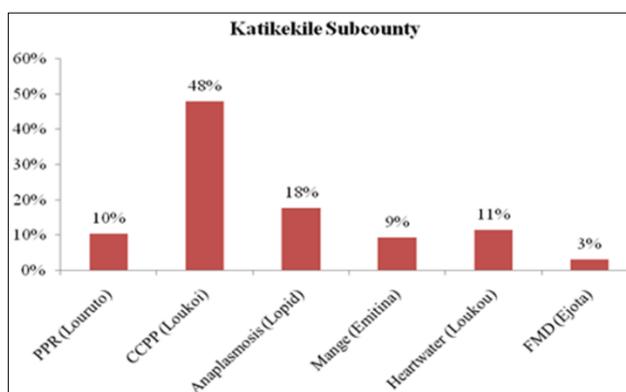


Fig 3: Level of individual disease severity among livestock in Katikekile Subcounty in Moroto District as per community perceptions through proportional piling

Figure 3 is a bar graph showing the level of disease severity of common disease conditions affecting livestock in Katikekile Subcounty. CCPP had the highest severity (48%), followed by anaplasmosis (18%), then Heartwater (11%) and PPR (10%).

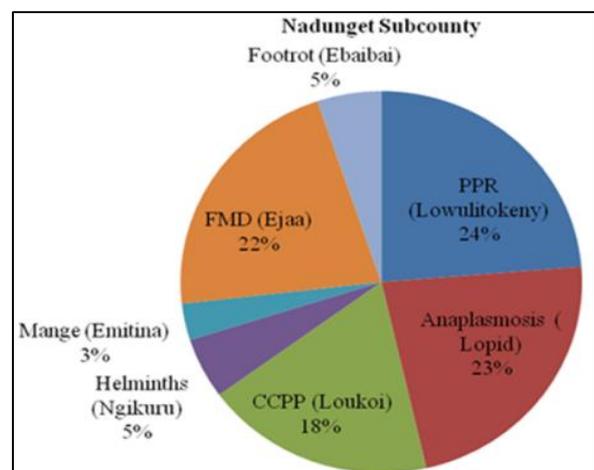


Fig 4: Prevalence of disease conditions among livestock in Nadunget Subcounty in Moroto District as per Community perceptions through proportional piling

For Nadunget Subcounty, the prevalence levels of common disease conditions affecting livestock are presented in Figure 4, a pie chart. PPR had the highest prevalence (24%), followed by anaplasmosis (23%), then FMD (22%) and CCPP (18%).

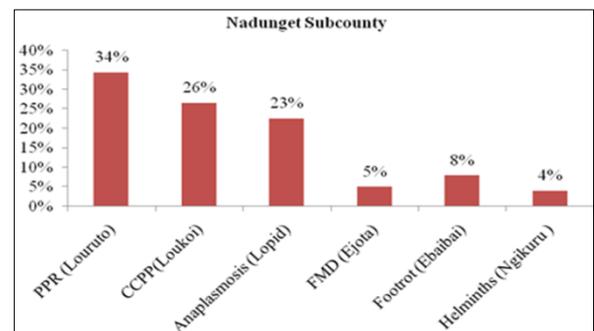


Fig 5: Level of individual disease severity among livestock in Nadunget Subcounty in Moroto District as per community perceptions through proportional piling

Figure 5 is a bar graph showing the disease severity of the common diseases affecting livestock in Nadunget

Subcounty. PPR (34%) had the highest severity followed by CCPP (26%) and then anaplasmosis (23%).

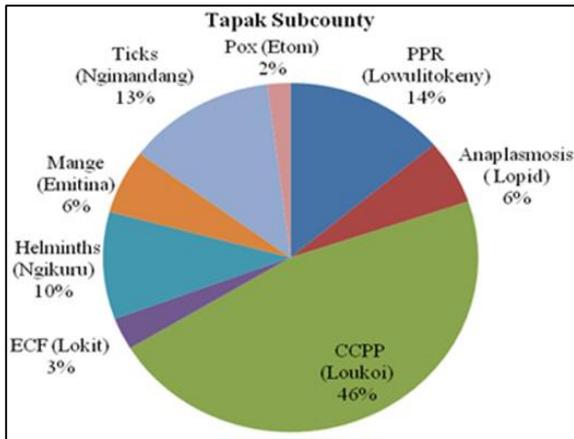


Fig 6: Prevalence of disease conditions among livestock in Tapak Subcounty in Moroto District as per Community perceptions through proportional piling

Figure 6 is a pie chart showing prevalence levels of common diseases affecting livestock in Tapak Subcounty. CCPP had the highest prevalence (46%), followed by PPR (14%) and then tick infestation (13%).

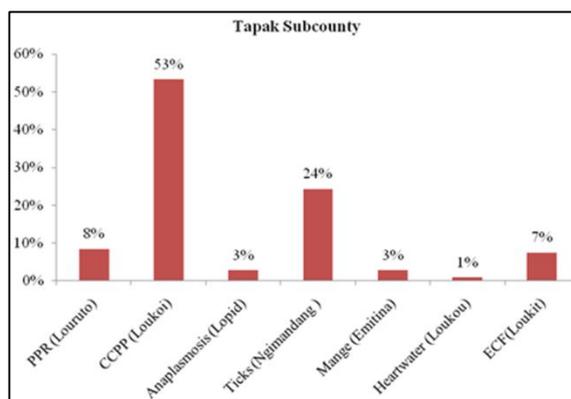


Fig 7: Level of individual disease severity among livestock in Tapak Subcounty in Moroto District as per community perceptions through proportional piling

Figure 7 is a bar graph showing the disease severity as assessed by community observation in Tapak Subcounty. CCPP had the highest severity (53%) and followed by tick infestation (24%).

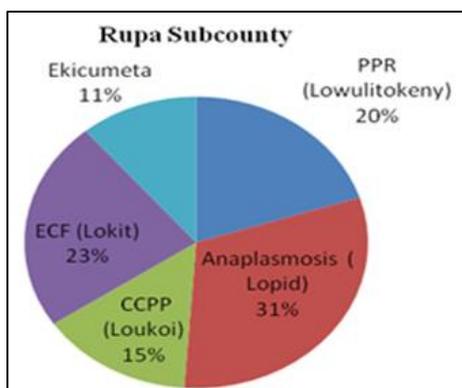


Fig 8: Prevalence of disease conditions among livestock in Rupa Subcounty in Moroto District as per Community perceptions through proportional piling

Figure 8 is a pie chart showing prevalence levels of common diseases affecting livestock in Rupa Subcounty. Anaplasmosis had the highest prevalence (31%), followed by ECF (23%) and then PPR (20%).

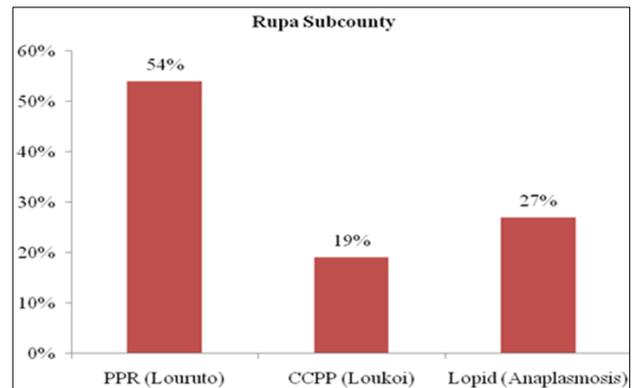


Fig 9: Level of individual disease severity among livestock in Rupa Subcounty in Moroto District as per community perceptions through proportional piling

Figure 9 is a bar graph showing disease severity among livestock in Rupa Subcounty, with PPR having the highest severity (54%) followed by anaplasmosis (27%).

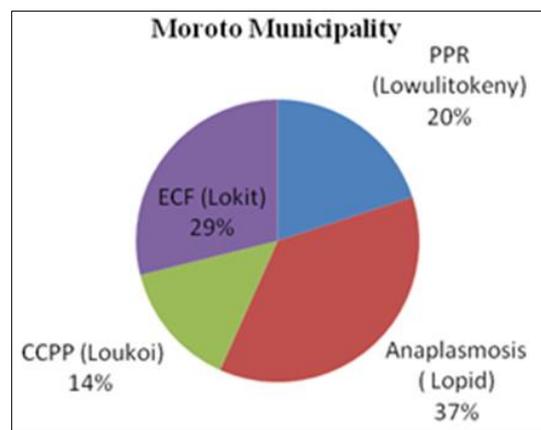


Fig 10: Prevalence of disease conditions among livestock in Moroto Municipality in Moroto District as per Community perceptions through proportional piling

Ultimately, prevalence levels of common diseases affecting livestock in Moroto Municipality are shown in Figure 10, a pie chart. Anaplasmosis had the highest prevalence (37%), followed by ECF (29%) and PPR (20%).

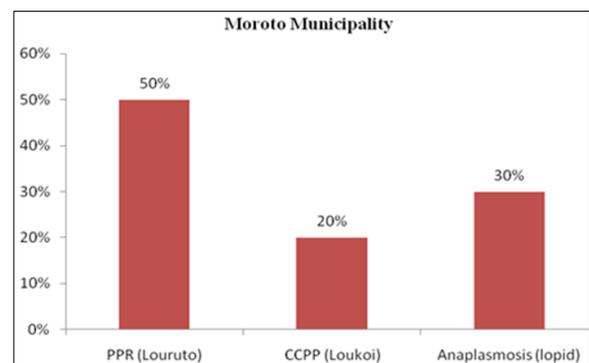


Fig 11: Level of individual disease severity among livestock in Moroto Municipality in Moroto District as per community perceptions through proportional piling

For disease severity, PPR had the highest severity (50%), followed by anaplasmosis (30%) as presented in Figure 11.

4. Discussion

We report on a Participatory Disease Search that was conducted in subcounties of Katikikile, Nadunget, Tapak, Rupa and Moroto Municipality in Moroto district with the aim of investigating the prevalence of PPR, possible risk factors for its spread and level of awareness among livestock keepers of the disease. Livestock keepers interviewed were aware of PPR and through proportional piling assessed the PPR prevalence to be 21.6%, hence confirmed its importance and presence within the subcounties visited in Moroto district. In addition, communities interviewed were aware of other related diseases such as CCPP, Anaplasmosis, ECF, Heartwater, FMD, Mange, Helminths, Tick infestation and Footrot. In line with these findings, conventionally, Contagious Caprine Pleuropneumonia, Bluetongue, Pasteurellosis, Contagious Ecthyma (Orf), Foot and Mouth Disease (FMD), Heartwater, Coccidiosis and mineral poisoning are known to be differential diagnoses for PPR (AU-IBAR, 2014) [10]. In addition, PPR severity of 32.4% by livestock keepers favorably compared with conventional literature that puts PPR mortality rates between 50 and 80 percent and PPR morbidity rates of 80 and 90 percent (Taylor, 2015) [1]. Despite the small sample size analyzed serologically for PPR, detecting of seropositive goats and sheep further confirmed presence of PPR in Moroto district, hence corroborating the views of livestock keepers.

Whereas not much was discussed by key informants and focus groups regarding the risk factors influencing spread of PPR in Moroto, secondary data sources indicated that routine annual migration of livestock from different districts in Karamoja, which characterizes the transhumance system, does favour disease transmission among mixing herds (C & D, 2010) [11]. In addition, the high stock density during the drier months of the year causes overgrazing of the limited pasture around watering points in grazing areas leading to presence of such organic matter in muddy or stagnant water sources, favoring the survival of parasites and the transmission of infectious diseases (C & D, 2010) [11]. Furthermore, introduction of new animals in the herd, especially through stealing animals during frequent raids in Karamoja, facilitates disease transmission (C & D, 2010) [11]. The tradition of distributing raided animals amongst raiders enhances the risk of spreading or introduction of infections to new areas and herds within Karamoja (C & D, 2010) [11]. Not to mention the fact that certain aspects of the culture, the social traditions and the livestock management of the ethnic groups living in Karamoja affects the intra-species disease transmission (C&D, 2010) [11].

A Participatory Disease Search/Participatory Epidemiology (PDS/PE) study design and tools according to Catley & Berhanu (2003) [8] and CAHO (2011) [9] were employed in the case study. Semi-structured interviews were administered to key informants and focus groups of livestock keepers. The focus group discussion was very crucial in assessing knowledge of communities on existing common diseases including PPR and the severity of diseases. In addition, it was important in assessing the community awareness on PPR presence. Proportional piling was employed to assess the prevalence of diseases including PPR. For purposes of clear understanding during interviews,

a case definition for PPR had the following major clinical signs: sudden onset of depression, fever, discharges from the eyes and nose, sores in the mouth, laboured breathing and cough, foul-smelling diarrhea and death. Participatory epidemiology has proved to provide a voice to communities while increasing the understanding of health problems and the options for their prevention, control and surveillance (Catley *et al.*, 2012, Jost *et al.*, 2007) [12, 13]. Participatory methods were used by veterinarians in community-based livestock projects in Africa and Asia in the 1980s. Participatory methods were further developed and helped enhance the effectiveness of rinderpest surveillance in pastoralist systems in Africa (Allepuz *et al.*, 2017) [14].

Communities interviewed during focus group discussions in Moroto district confirmed presence PPR in Katikikile, Nadunget, Tapak and Rupa Subcounties, including in Moroto municipality. Corresponding PPR disease severity levels was confirmed for the said subcounties. The community assessment through PDS tools fully supported and corroborated earlier findings of conventional serological studies. Ruhweza *et al.* (2010) [4] reported seroprevalence of PPR of 9.4% in Karamoja sub-region. Further studies by Mulindwa *et al.*, (2011) [15] in Karamoja Sub-region revealed a seroprevalence of 57.6%.

In conclusion, PPR is still present in Moroto district. Routine annual migration of livestock from different districts in Karamoja sub-region; mixing of herds; introduction of new animals in the herd during frequent raids; social traditions and the livestock management of the ethnic groups living in Karamoja are the critical risk factors influencing the spread of PPR. Further routine surveillance through PDS is likely to help guide the effective prevention and control of PPR in Moroto District.

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6. Competing interests

Authors of this manuscript declare that they have no competing interests.

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