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Practices in the pig value chain in Uganda; implications to African swine fever transmission

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Abstract

Uganda has the largest pig industry in eastern Africa, with majority of farmers still smallholders. African swine fever (ASF) is arguably one of the major constraints in the region, where it is considered endemic. Although the sylvatic cycle exists here, the pig-pig cycle of transmission is more important. The pig value chain is one critical area where there is need for study of the role it plays in the spread of ASF. In this study, different practices and their association with the transmission of ASF within and between farms were investigated on 101 pig farms in Uganda. Practices by 30 traders in pigs and pig products (slaughter slab, pork butchery and roasted pork restaurant operators) were investigated in the districts of Kabarole, Mityana, Moyo, Mukono, Soroti, and Tororo. Key informant interviews with the District Veterinary Officers (DVOs) about pig trade, pig slaughter infrastructure, ASF status and its management in the districts were conducted as well between May-November 2011. Questionnaires were administered to both pig farmers and the traders.

Twenty six percent of the farmers reported having had the disease on the farm in the last one year. Although none of the risk factors was statistically significant for ASF outbreaks, results demonstrated presence of potential risk factors for ASF on the farms and the rest of the pig value chain.

Keywords: *ASF, pig farms, pigs, risk factors, traders*

Introduction

ASF is caused by a large icosahedral DNA virus, genus *Asfivirus*, family *Asfarviridae* (Dixon et al 2005). African swine fever virus (ASFV) has 22 genotypes identified so far and all of these have been documented in Africa (Sánchez-Vizcaíno and Neira 2012). The disease is currently endemic in at least 26 countries in sub-Saharan Africa (Penrith et al 2013) , on the island of Sardinia (Italy) and since a few years also in the Caucasus and the Russian Federation. Especially in Africa, the Caucasus and the Russian Federation, the disease is having a particularly devastating impact on smallholder pig farmers, who are losing a valuable protein source and a cash income. Recent developments in eastern Europe

suggest that a further expansion (FAO 2012).

Uganda has a population of approximately 33 million people according to Uganda Bureau of Statistics (Uganda Bureau of Statistics (UBOS) 2011). With an increasing middle-class, this translates into an increasing need for food. The Uganda pig population stands at about 3.5 million pigs (Uganda Bureau of Statistics (UBOS) 2012), but is faced with many constraints like ASF. The upsurge in ASF in sub-Saharan Africa (SSA) is believed to be a result of growth in the pig sector in Africa with some countries more than doubling their pig populations in less than a decade and the increase of movement of people and pig products (FAO 2012).

The pig value chain in Uganda involves many actors and is mostly informal, an observation in developing countries made earlier by Perry and Grace (2009) . It involves the producers (pig farmers), middlemen, slaughter slab operators, butchers, roasted pork restaurant operators and finally the consumers. Involvement of veterinary services and government in regulation and funding livestock development is still low. Rich and Perry (2011) noted the constraints inherent among farmers, veterinary services and other value chain actors and advised that disease control strategies needed to recognize those constraints. Whereas this is the case in livestock value chains as a whole, from observation the pig value chain in Uganda seems to be at a greater disadvantage making control and prevention of diseases like ASF very difficult.

The aims of this study were therefore to document the different factors and practices within the pig value chain that could influence the transmission of ASF and secondly, to assess the potential risk factors for the ASF outbreaks on the pig farms.

Materials and methods

Study area

The study was carried out in Kabarole, Mityana, Moyo, Mukono, Soroti, and Tororo districts in Uganda. A total of 101 farms and 30 slaughter slabs, butcheries and roasted pork (barbecue) restaurants were selected. Key informant interviews with District Veterinary Officers (DVOs) in the 6 districts were also carried out. Observations were made on the different value chain actors and the practices in the 6 districts.

Data collection

A cross-sectional study was carried out in the districts of Kabarole, Mityana, Moyo, Mukono, Soroti, and Tororo. A total of 101 farms and 30 pig trade businesses (slaughter slabs, butcheries and roasted pork restaurants) in these districts were selected among the sub counties with large numbers of pig farms based on the information obtained from the DVOs. At least two sub counties were selected per district.

Information on management practices on farms and practices in businesses was collected using a questionnaire with closed and open-ended questions. The questionnaires were initially discussed with local veterinary personnel (enumerators) to make sure they understood the questions since they had to be translated into local languages. During the farm visits, farmers were asked if they had ASF outbreak on their farms in the previous year. In addition, information on management practices, biosecurity measures (whether a farm had all the pigs housed, controlled entrance, presence of footbaths) and general information on the farm were taken. The clinical signs of ASF were described to make sure the

farmers understood ASF and its signs. The traders were also asked about practices in their businesses and whether they had been affected by ASF in any way.

Interviews with the DVOs about pig trade, pig slaughter infrastructure, status of ASF and its management in the districts were conducted using a checklist of questions. Observations on the pig slaughter infrastructure and responses in cases of outbreaks were made.

Data analysis

Data captured from questionnaires was entered into Microsoft Excel 2007 (Microsoft Corporation) and later exported into R statistical package (Version 2.15.2) for analysis (R Development Core Team 2011). A multivariable logistic regression model was used to assess the association between ASF outbreak reports on farms and management practices and all variables with *P*-value less than 0.25 in univariable analyses were put into the model and a backward elimination process was performed using a *P*-value of 0.05. Confounding was considered present during the model building process if point estimates of the variables in the model changed by more than 20% when variables were eliminated, but no confounding was observed (Dalgaard 2008). Descriptive statistics were run in Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, Washington). Qualitative data got using a checklist was captured and reported.

Results

Analysis of potential risk factors on farms

A total of 101 farmers from the districts of Kabarole, Mityana, Moyo, Mukono, Soroti, and Tororo were interviewed and the relative proportions for the potential risk factors were as shown in Table 1.

Table 1 . Cross tabulations of the Risk factors for ASF outbreak on pig farms

	Reports of ASF			
Predictor	**No**	**Yes**	**NA**	**Total (n)**
Pigs housing				
Pigs housed	78[a]	22	0	59
Pigs not housed	66	32	2	41
NA	0	0	100	1
Awareness on ASF				
Aware	67	33	0	79
Not aware	100	0	0	19
NA	33	0	67	3
Feeding swill				
No	77	23	0	73
Yes	65	35	0	23
NA	40	20	40	5
Boar hiring/lending				
No	71	29	0	51
Yes	75	25	0	44
NA	67	0	33	6
Biosecurity measures				
None	65	35	0	37
At least one	79	21	0	62
NA	0	0	100	2
Pig trade in the neighbourhood				
No	71	26	3	35
Yes	74	26	0	65
NA	0	0	100	1

Slaughter slab on farm				
No	71	27	2	97
Yes	100	0	0	4

NA- Missing value, ASF-African swine fever

[a] The figures in all the cells in Columns for No, Yes, NA are percent proportions. For example, the first cell 78 is computed by dividing the absolute number for that cell by row total (that is 59) and multiplying by 100%.

Twenty six percent reported having had ASF outbreak on their farms, with a trend of higher proportion (32.0%) among those farms whose pigs were not housed. These pigs were either free ranging or tethered. A great majority (67.0%) stated that they were knowledgeable on the disease. Concerning the level of biosecurity, 79.0% had at least one biosecurity measure on their farms. Nineteen percent stated that they disposed of sick and dead pigs in ways like throwing pig carcasses in bushes, and selling of ASF suspected pigs for slaughter. However, 10.0% stated that they buried ASF suspect carcasses (Table 1). Although the predictors non housed pigs, and lack of biosecurity measures had $p<0.25$ (Table 2), none remained in a multivariable model (Table 2).

Table 2. Risk factors to ASF outbreak on pig farms

Predictors	OR	CI	p-value
Pigs housing			
Housed	1		
Not housed	1.704	(0.688;4.244)	0.248
ASF awareness			
Aware	1		
Not aware	-	-	-
Feeding swill			
No	1		
Yes	1.757	(0.617;4.803)	0.277
Boar hire			
No	1		
Yes	0.800	(0.316;1.979)	0.631
Biosecurity measures			
None	1		
At least one	0.490	(0.195;1.221)	0.125
Pig trade in neighbourhood			
No	1		
Yes	0.984	(0.389;2.601)	0.973
Slaughter slab on farm			
No	1		
Yes	-	-	- -

-Inestimable

NA: Missing value; ASF: African swine fever; OR: Odds ratio; CI: Confidence Interval; p-value-5% level of significance

Practices among traders (slaughter slab operators, butchers, roasted pork restaurant operators). Thirty traders (slaughter slabs, butcheries, and roasted pork restaurants) were surveyed (Table 3).

Table 3. Attributes among Slaughter slabs operators , butchers, roast pork restaurant operators, Uganda, 2011

	Report of ASF outbreak		
Predictor	**No**	**Yes**	**Total (n)**
Origin of Slaughter animals			
Within district	56[a]	44	9
Other districts	95	5	20
NA	100	0	1
Disposal of offals			
Proper	100	0	5
Improper	79	21	24
NA	100	0	1

Meat inspection			
No	80	20	15
Yes	86	14	14
NA	100	0	1
Pork sale frequency			
Daily	91	9	23
Weekly	57	43	7
Pork leftovers disposal			
Proper	50	50	2
Improper	84	16	25
NA	100	0	3
ASF awareness			
No	100	0	2
Yes	82	18	28
ASF suspects slaughter			
No	88	13	24
Yes	60	40	5
NA	100	0	1
Pig farms in vicinity			
No	100	0	2
Yes	81	19	27
NA	100	0	1
Pets			
No	100	0	1
Yes	83	17	29

NA-Missing value[a] The figures in all the cells in Columns for No, Yes, NA are percent proportions. For example, the first cell 56 is computed by dividing the absolute number for that cell by row total (that is 9) and multiplying by 100%.

The vast majority (95.0%) of the traders sourced pigs for slaughter from other districts. Seventy-nine percent of the traders reported disposal of pig products like offals and blood at compost or landfills, or feeding them to pigs and dogs. Eighty percent stated that their pork was not inspected by any veterinary or public health personnel. Seventeen percent said that they had ever slaughtered ASF suspected cases. A schematic model of the pig value chain in Uganda can be seen in figure 1.

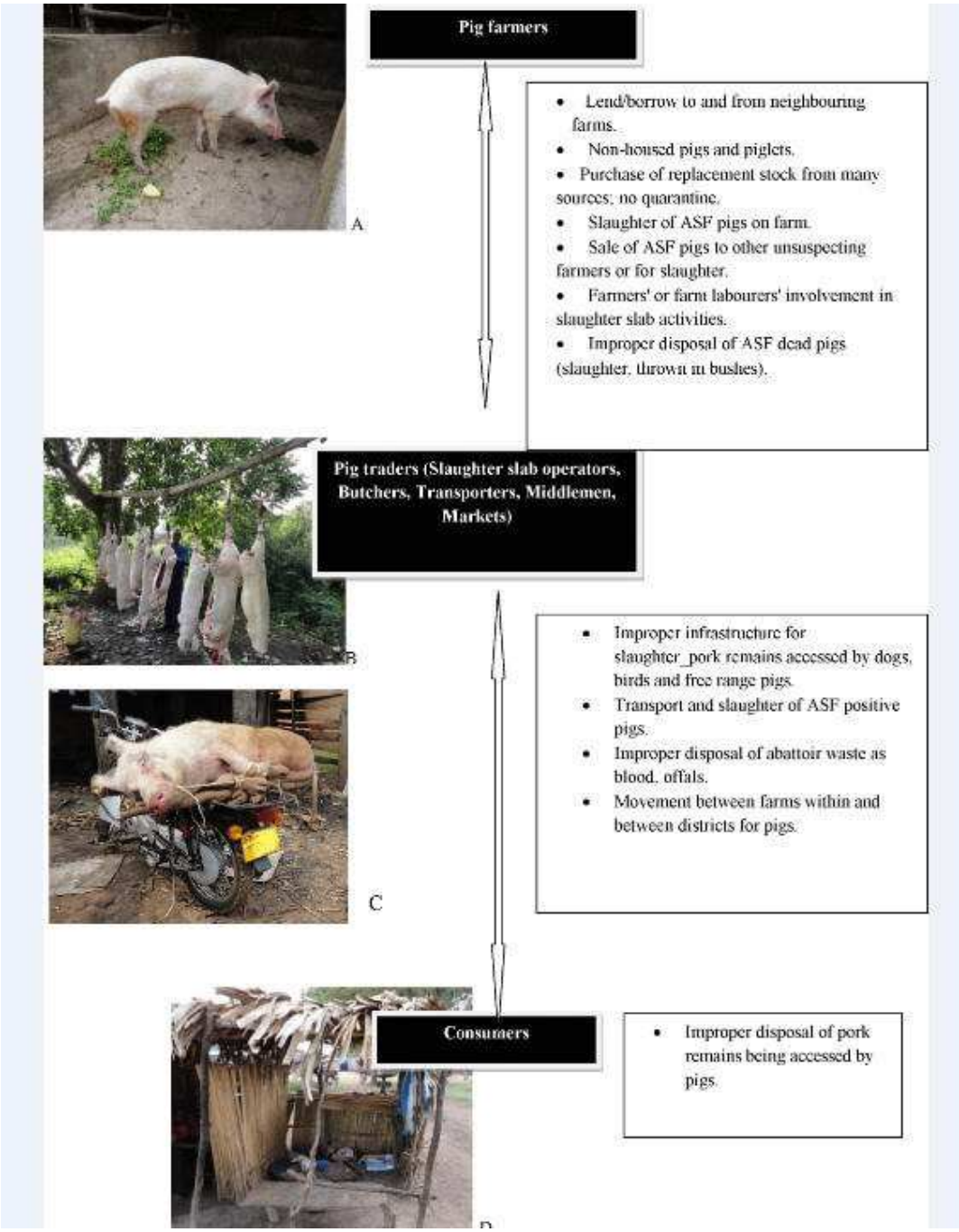

Figure 1. Representation of the pig value chain in Uganda highlighting practices risky to ASF spread. A, Sick pig at a farm in Mityana, central Uganda. B, Slaughter slab in Mityana, central Uganda. C, ASFV-positive pig (confirmed by real time Polymerase chain reaction) on arrival at a slaughter slab. D, Pork butchery

Generally, the slaughter slab operators in Soroti and Tororo reported that their pork was inspected by veterinary personnel compared to their counterparts in other districts. In Mityana, many farmers collected offals from slaughter slabs for feeding to their pigs. In Soroti, some people frequented slaughter slabs and took away offals for consumption.

Key informant interviews with District Veterinary Officers

The DVOs concurred that sometimes during the ASF outbreaks, the imposed trade movement bans on pigs and pork products constrain the traders and farmers, making enforcement difficult. The DVOs in the five districts noted that the infrastructure for pig slaughter was poor or non-existent. In Moyo, the district had erected some stone and sand slaughter slabs. Where the slaughter slabs were non-existent,

the traders usually slaughtered on the ground, with or without wooden or concrete platforms. Such slabs were normally not fenced. The DVOs felt that the central government had not paid adequate attention to pig slaughter infrastructure. This consequently made veterinary monitoring and inspection of pig slaughter operations very difficult and infrequent. During ASF outbreaks, all the DVOs reported to MAAIF although confirmation was not always done. Quarantines were enforced with varying compliance results. During our visits to the study areas, Moyo and Soroti had ASF and Foot and Mouth Disease (FMD) quarantines. The compliance in Moyo was very good whereas in Soroti, some slaughter slab operators were observed slaughtering clandestinely despite FMD quarantine being in place at the time. On trade in pigs and pork, the DVOs stated that it is probable that outbreaks were spilling over from neighboring districts due to difficult in enforcing pigs and pig products movement controls.

Discussion

Uganda is considered endemic for ASF. The pig value chain in Uganda is arguably a key area where there is a high risk of ASF transmission across the different districts. The husbandry practices and on-farm biosecurity measures merit attention as they may be drivers of ASF spread. A number of practices like purchase of replacement stock from neighbouring farms without due consideration of whether the pigs were free of the disease or not through initial isolation, sharing of breeding boars among neighbouring farms, pigs and piglets that were not housed and allowing free access of visitors to farms without consideration to disinfection were identified on the pig farms. A vast majority of pig farms had pigs trade activities in their vicinity and in a few cases, slaughter slabs were on the farm premises with one of them having a slaughter slab servicing other farmers and pig traders (Table 1 and 2). There were also practices like selling of sick and dead pigs, slaughter and throwing carcasses or their offals in bushes. There is a high possibility of these wastes being accessed by dogs, scavenging birds and taken to nearby farms or by free range pigs as observed (Figure 1). None of the potential risk factors was statistically significant for ASF outbreaks on the farms (Table 2), possibly because the sample size was small and secondly the self-reporting of ASF by farmers may have included other differential diagnoses since confirmation could not be established. Other studies (Fasina et al 2012) have shown some of these risk factors to be highly significant. There is need for sensitization of pig farmers and traders to appreciate good management practices and biosecurity measures since potential risks were present. Therefore empowering the pig farmers and other value chain actors to better respond to ASF in a sustainable and realistic manner in light of limited capacity by veterinary services is critical (FAO 2012).

In the current study, some traders stated having bought pigs on affected farms at reduced prices. This and other practices (Table 3) in the pig value chain constitute high risks to spread of ASF. The scenario is complicated by the fact there is no incentive in place to foster compliance to disease control measures as suggested by Rich and Perry (2011) earlier. Compliance with quarantine put in place by the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) varies among districts depending mainly on magnitude of enforcement of the law. In some districts, slaughter, trade and movement of pigs could be observed even when there was a quarantine in place. In the circumstances, farmers do fire-fighting during outbreaks whereby they sell pigs on infected farms (sick and in-contact pigs), an observation made earlier in another study in Uganda (Muwonge et al 2012). A number of slaughter slab operators also confirmed slaughtering and selling meat that was not inspected by the veterinary and public health personnel, presenting a loophole for spread of ASF and other diseases. This and other practices in the pig value chain (Figure 1) present serious ramifications for the control of spread of ASF.

Information from DVOs confirmed that slaughter infrastructure and ASF control and prevention

strategies required attention. Sentiments expressed by Perry and Grace (2009) confirm that animal disease control in many African countries has been deteriorating and call for a well-funded and highly performing veterinary system for better disease control.

Conclusion

- Although potential risk factors existed on the pig farms, there were no statistically significant risk factors. Potential risk factors also existed among pig traders (slaughter slabs, butcheries and pork restaurants), presenting opportunity for transmission of ASFV. According to the DVOs, the policies like quarantine instituted during outbreaks were hardly followed. Information gathered indicated that pig slaughter facilities are under-developed, a situation which makes prevention and control of ASF and other diseases difficult.

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Conflict of interest

The authors declare that there was no conflict of interest in the execution and reporting of the work in this study. The relationship with persons and organisations did not in any way influence the reporting of the findings.

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Go to top