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ABSTRACT

The overall goal of this doctoral thesis was to address the gap on epidemiology of important respiratory pathogens and their economic impacts on smallholder pig production systems in Uganda. Specifically, it aimed to i) determine prevalence and management risk factors for respiratory pathogen and gastro-intestinal helminth infections in domestic pigs, ii) determine molecular characteristics of porcine reproductive and respiratory syndrome virus (PRRSv) identified from slaughtered pigs, iii) establish correlations between serologic status and lung pneumonic lesions in slaughtered pigs and iv) quantify economic losses associated with exposure to respiratory pathogens. The specific pathogens targeted in this study were porcine reproductive and respiratory syndrome virus (PPRSv), porcine circovirus type 2 (PCV2), *Mycoplasma hyopneumoniae* (*M. hyo*) and *Actinobacillus pleuropneumoniae* (*App*). The first study was a desk review on status and gaps of research on swine respiratory pathogens in Africa. The pathogens included in the review were PPRSV, PCV2, *M. hyo*, *App* and swine influenza A viruses (IAV). This was followed by three (3) cross-sectional studies on pig respiratory pathogen prevalence and risk factor identification, and a slaughter slab survey to assess correlations between serology and lung pneumonic lesions. Blood samples were collected and used to determine exposure of pigs to respiratory pathogens using ELISA assays. Tissue samples collected from slaughtered pigs were used to extract viral RNA, and a real-time reverse transcriptase PCR (RT-qPCR) was used to characterize PRRSV species. The final (5th) study was longitudinal and conducted in a repeated measures design, sought to quantify economic losses (ADGs and financial costs) associated with exposure of pigs to respiratory pathogens. A mixed effects model was fitted to estimate effects of respiratory infections on ADGs, with farm as a random effect. All these studies were conducted in Lira district, Uganda from October 2018 to September 2019.

Results highlighted major knowledge, information gaps on epidemiology, and economic impacts of the 4 studied pathogens reported in pigs in Africa, which justified further studies. The individual animal seroprevalence of studied pathogens was *M. hyo* 6.4% (95% CI 3.5–10.5), PCV2 6.9% (95% CI 3.7–11.1), PRRSV 13.8% (95% CI 8.8 – 19.6), and *App* 30.4% (95% CI 24.8–36.5). The prevalences of GIT parasites were: *Ascaris spp* 12.7% (95% CI 8.6-16.8), *Strongyles spp* 16.2% (95% CI 11.7-20.7) and *Eimeria spp* 56.4% (95% CI 50.3-62.4). Pigs infested with *Ascaris spp* were more likely to test positive to PCV2, with odds ratio (OR) of 1.86 (CI 1.31-2.60; p=0.0002). Pigs that had parasite infestations were more likely (*Strongyles spp.* and *Ascaris spp.* ORs 3.5 and 3.4, p<0.001, respectively) to have respiratory co-infections. For *M. hyo*, infection with *Strongyles spp* was a risk factor (OR 12.9, p<0.001). These findings strengthened evidence of the role of



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hygiene and biosecurity in reducing disease incidence in herds. We found that there was dual circulation of both PRRSv type 1 (PRRSv-1) and type 2 (PRRSv-2) in slaughtered pigs in northern Uganda. Results revealed a high prevalence and severity of pneumonic lesions (range 17.4 – 74.2%) in lungs of slaughtered pigs. The mixed effects model showed that a weaner/grower pig in a given farm exposed to PRRSv and *Ascaris spp* infection had significantly lower daily weight gain (ADGs) by 18.47 and 23.68 grams respectively, compared to a similar unexposed pig. We showed that monetary losses encountered by farmers due to PRRSv and *Ascaris spp.* infection amounted to USD 7.12 and USD 9.16 respectively, per pig during fattening (200 days). The last study highlighted the role good management plays to mitigate adverse effects of respiratory infections in pigs. In conclusion, this study has revealed that the most important respiratory pathogens are PRRSv, PCV2, *App*, *Ascaris spp* and factors for their spread are poor hygiene & biosecurity, and concurrent GI parasite infestations. The most predominant species of PRRSv detected was PRRSv-1. The associations of these pathogens with other pathogens are important for disease precipitation. The associations between serology and lung lesions, and economic losses associated with exposure to respiratory pathogens points to a need to focus attention to their prevention and control to improve pig production and productivity in Uganda.