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***Ex-ante* impact of Marek’s disease mitigation on economic viability of small-scale intensive layer production in Ghana**

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Abstract

The mitigation strategies for control of Marek’s disease in poultry production include revaccination (double vaccination) of day-old chicks, selection of genetically resistant breeds, and the implementation of biosecurity measures. However, limited evidence exists regarding the economic impact and trade-offs of adopting these mitigation strategies either alone or in combination with others. This study examines the ex-ante impact and trade-offs associated with the implementation of strategies against Marek’s disease on the economic viability of small-scale intensive layer production systems in Ghana. The analyses focused on four producer typologies – including locally hatched chicken cohort and systematic production schemes as well as imported cohort and systematic production schemes.

A system dynamics model, segmented into three modules comprising of an integrated production-epidemiological, financial, and management decision modules, was developed using the Stella Architect software, parameterised with a mix of primary and secondary data, and simulated for 700 days at a daily timestep. The model structure was validated with stakeholders using a participatory approach, while extreme condition tests were conducted to validate the robustness of the model behaviour.

The findings reveal that implementing revaccination can mitigate the economic impact of Marek’s disease for farmers using locally hatched day-old chicks, reducing losses by 76.27% and 76.31% in systematic and cohort production schemes, respectively. However, revaccination alone fails to alleviate the economic impact when using imported day-old chicks. Under both cohort and systematic schemes, Marek’s disease-related losses rise by an average of 25.58%.

Comparatively, implementing only biosecurity measures is more cost-effective than relying solely on revaccination. The average benefit cost ratio for revaccination increased from 0.39 to 1.18 and 0.40 to 1.22 when exposed and infected birds are culled by farmers in cohort and systematic production schemes, respectively. Opting for systematic production with locally hatched day-old chicks over cohort production with imported day-old chicks results in a gross margin loss of 0.87% \pm 8.31 with biosecurity measures alone and 0.21% \pm 3.11 with revaccination alone. This study’s findings inform poultry farmers about some cost-effective disease mitigation strategies available to them in the control of Marek’s disease.

Keywords: Biosecurity, chicken, food security, systems dynamics, vaccination