GENETIC DIVERSITY, GROWTH PERFORMANCE, NEWCASTLE DISEASE RESISTANCE AND RESPONSE TO SELECTION OF INDIGENOUS CHICKEN IN RWANDA

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ABSTRACT

Indigenous chicken (IC) are found wherever there are human settlements in Rwanda. Their preference to exotic chicken breeds by farmers could be attributed to their small production cost, scavenging ability, and adaptability to the harsh scavenging environment. Their productivity, however, is low. Improvement of genetic potential of IC in Rwanda had been attempted without success by crossing them with exotic chicken breeds. There was, therefore, the need for an alternative approach to genetic improvement. Genetic improvement through a within-breed selection has been recommended as an alternative strategy. Such a strategy, however, is lacking in Rwanda. The objective of the current study was to generate the information needed to establish an IC breeding programme using within breed selection in Rwanda. The primary step was to identify distinct IC ecotypes in Rwanda through phenotypic and genetic characterisation using morphobiometrical traits and twenty-eight microsatellite markers, respectively. The next phase of the research focused on evaluating the growth and Newcastle disease (ND) resistance performances and their associated genomic regions through genome-wide associated studies (GWAS) using a mixed linear model (MLM). Lastly, a deterministic simulation was performed to estimate the response to the selection of IC for both meat and egg production using within-breed selection strategy in conventional (*CBS*) and genomic (*GBS*) breeding schemes. The IC ecotypes were found to be diverse morphologically both in quantitative and qualitative traits. Based on molecular analysis, IC populations showed high levels of significant genetic heterogeneity and clustered into four separate gene pools. Analysis of growth performance and antibody response to Newcastle disease of IC revealed significant differences ($P<0.001$) among the four gene pools. In total, eight significant genomic regions that could putatively regulate body weight and antibody response to ND in IC in Rwanda were identified. This reveals the genetic control of these traits and making genetic markers available for selective breeding programmes to improve growth performance and ND resistance in IC. Finally, the study demonstrated that it is possible to improve IC through a within-breed selection strategy for both egg and meat using either *CBS* or *GBS* due to their high genetic diversity. In addition, the study revealed that GBS outperformed CBS in rates of genetic gain and inbreeding. Generated knowledge in this study is useful for the development of a sustainable IC breeding programme for enhanced IC productivity and improved human livelihood in Rwanda.

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