

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



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A Thesis Submitted to the Graduate School in Partial Fulfilment of the Requirements
for the Doctor of Philosophy Degree in Animal Science of Egerton University

2021/114198

EGERTON UNIVERSITY



MAY, 2021

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.

TABLE OF CONTENTS

DECLARATION AND RECOMMENDATION	ii
COPYRIGHT	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
ABSTRACT	vi
LIST OF TABLES	xii
LIST OF FIGURES	xiv
LIST OF ABBREVIATIONS AND ACRONYMS	xv
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background information	1
1.2 Statement of the problem	2
1.3 Objectives	2
1.3.1 Overall objective	2
1.3.2 Specific objectives	3
1.4 Research questions	3
1.5 Justification of the study	3
CHAPTER TWO	5
LITERATURE REVIEW	5
2.1 Indigenous chicken production in tropics	5
2.2 Phenotypic characterisation of indigenous chicken genetic resources	6
2.2.1 Indigenous chicken breed or ecotype description	6
2.2.2 Morphological and production characteristics of indigenous chicken	7
2.3 Indigenous chicken genetic diversity and assessment of genetic diversity	8
2.4 Indigenous chicken genetic improvement in Africa	9
2.5 Genomic tools for genetic improvement	11
2.5.1 Markers and maps	11
2.5.2 Whole-genome sequence of the chicken	11
2.5.3 Single Nucleotide Polymorphisms (SNP) markers	12
2.5.4 Genome-wide association studies	12
2.5.5 Genomic selection	13

CHAPTER THREE	-----14
MORPHOLOGICAL CHARACTERISTICS OF INDIGENOUS CHICKEN	
ECOTYPE POPULATIONS IN RWANDA	-----14
3.1 Introduction	-----15
3.2 Materials and methods	-----16
3.2.1 Study sites	----- 16
3.2.2 Study population	----- 16
3.2.3 Sampling and data collection	----- 16
3.2.4 Statistical analysis	----- 17
3.3 Results	-----17
3.3.1 Feather morphology, distribution and colour of indigenous chicken ecotype populations in Rwanda	----- 17
3.3.2 Head shape and ear lobe colour of IC ecotype populations in Rwanda	----- 21
3.3.3 Shank colour, shank feather and comb type of IC ecotype populations in Rwanda	----- 22
3.3.4 Variation in body weight and other linear body measurements of IC ecotypes in Rwanda	----- 25
3.4 Discussion	-----31
3.4.1 Feather morphology and distribution	----- 31
3.4.2 Feather colour	----- 31
3.4.3 Head shape	----- 32
3.4.4 Ear lobe colour	----- 32
3.4.5 Shank colour and feather	----- 33
3.4.6 Comb type	----- 34
3.4.7 Bodyweight and other linear body measurements	----- 35
3.5 Conclusion	-----36
 CHAPTER FOUR	 -----37
GENETIC DIVERSITY AND POPULATION STRUCTURE OF INDIGENOUS	
CHICKEN IN RWANDA USING MICROSATELLITE MARKERS	-----37
4.1 Introduction	-----38
4.2 Materials and methods	-----39
4.2.1 Collection of samples and DNA extraction	----- 39

4.2.2	PCR amplification and DNA polymorphism-----	40
4.2.3	Statistical analysis-----	44
4.3	Results -----	
	45	
4.3.1	Genetic diversity -----	45
4.3.2	Genetic relationship -----	51
4.3.3	Population structure -----	53
4.4	Discussion -----	55
4.4.1	Genetic diversity -----	55
4.4.2	Genetic relationships-----	56
4.4.3	Population structure -----	58
4.5	Conclusion -----	59
 CHAPTER FIVE-----		60
GROWTH PERFORMANCE AND NEWCASTLE DISEASE ANTIBODY TITRES IN FOUR GENE POOLS OF INDIGENOUS CHICKEN IN RWANDA -----		60
5.1	Introduction -----	61
5.2	Materials and methods-----	62
5.2.1	Study sites-----	62
5.2.2	Study population-----	62
5.2.3	Sampling, data collection, and management of experimental chicken-----	63
5.2.4	Data analysis-----	63
5.3	Results -----	64
5.3.1	Growth performance -----	64
5.3.2	Antibody titres for Newcastle disease vaccine -----	67
5.4	Discussion -----	68
5.4.1	Growth performance -----	68
5.4.2	Immune Response -----	69
5.5	Conclusion -----	71

CHAPTER SIX	72
GENOMIC REGIONS FOR GROWTH PERFORMANCE AND IMMUNE RESPONSE TO NEWCASTLE DISEASE VIRUS OF INDIGENOUS CHICKEN IN RWANDA	72
6.1 Introduction	73
6.2 Methodology	74
6.2.1 Experimental birds	74
6.2.2 Phenotyping	74
6.2.3 Genotyping	75
6.2.4 Reads alignment and SNP calling	75
6.2.5 Data analysis	75
6.3 Results	77
6.3.1 Population structure of indigenous chicken in Rwanda	77
6.3.2 Genome-wide association studies	78
6.4 Discussion	85
6.4.1 Population structure of indigenous chicken in Rwanda	85
6.4.2 Genome-wide association studies	85
6.5 Conclusion	92
CHAPTER SEVEN	93
RESPONSE TO SELECTION OF INDIGENOUS CHICKEN IN RWANDA USING WITHIN-BREED SELECTION STRATEGY	93
7.1 Introduction	94
7.2 Materials and methods	95
7.2.1 Procedure	95
7.2.2 Indigenous chicken breeding goal and traits in the breeding objective	96
7.2.3 Genetic, phenotypic parameters and genetic correlations	96
7.2.4 Breeding programme, schemes and population structure	98
7.2.5 Prediction of response to selection	100
7.2.6 Prediction of rate of inbreeding	101
7.2.7 Optimum nucleus size	101
7.3 Results	102
7.3.1 Response to selection in the breeding programme	102
7.3.2 Optimum nucleus size	103

7.4	Discussion -----	105
7.4.1	Rates of genetic gain and inbreeding of indigenous chicken in CBS and GBS -----	106
7.4.2	Optimum nucleus size -----	109
7.4.3	Practical implications-----	110
7.5	Conclusion -----	110
 CHAPTER EIGHT-----		111
GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS-----		111
8.1	General discussion -----	111
8.2	Conclusions -----	114
8.3	Recommendations-----	114
8.4	Areas for further studies-----	115
 REFERENCES-----		116
 APPENDICES-----		157
Appendix A. Research permit -----		157
Appendix B. Ethical clearance -----		158
Appendix C. Indigenous chicken Morphobiometrical Characterisation-Questionnaire -----		159
Appendix D. Publications -----		160
Appendix E. QQ-Plots revealing the relation of normal theoretical quantiles of the probability distributions between expected (x-axis) and observed (y-axis) p-values-----		164
Appendix F. Catalogue of all genes located 100 kb upstream and downstream of the significant SNPs for body weight and antibody response to Newcastle disease in indigenous chicken in Rwanda -----		165