Integrating genetic and genomic analyses to enhance health and productivity of Ethiopian indigenous chickens

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Poultry production

Global Demand for Meat

2005 vs. 2050

Predicted Growth

Source: Food and Agriculture Organization of the United Nations, FAO Working Paper No. 15-02, p. 131
Increase of infectious disease

- Huge losses (monetary-welfare)
- Food-safety –public health (zoonosis)
- High cost of preventive measures

Breeding for improved disease resistance and immune (vaccine) response
Improving production, health and immunity of Ethiopian village chickens
• Indigenous chickens:
  • well adapted
  • low productivity
  • infectious diseases

Is it also possible to select for enhanced antibody responses and resistance to infectious diseases?
Ecotypes
Major infectious diseases - Phenotyping

- Fowl typhoid
- Fowl cholera
- Infectious Bursal Disease
- Marek’s Disease
- Newcastle Disease

- Coccidiosis
- Cestodes
- Ascarids
Genomic analysis

- Heritability and genetic parameters, GWAS, Selective Sweep analysis, WGS, pathway and network analysis, estimation of GEBVs, epidemiological modelling
Results

- The production, immune and health traits were moderately heritable

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability estimate (h²)</th>
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<tbody>
<tr>
<td>PM</td>
<td>0.3</td>
</tr>
<tr>
<td>IBDV</td>
<td>0.46</td>
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<tr>
<td>MDV</td>
<td>0.42</td>
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<tr>
<td>Eimeria</td>
<td>0.22</td>
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<tr>
<td>Cestodes</td>
<td>0.31</td>
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<tr>
<td>SG</td>
<td>0.08</td>
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<tr>
<td>Body Weight</td>
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<tr>
<td>BCS</td>
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</table>
• Genetic variants of interest highlighted through the WGS analysis in several immune related genes for all the antibody response and parasitic infection traits
Results

• The production, immune and health traits were moderately heritable

• No significant genetic correlations between production and health traits

• Interesting genetic correlations among immune traits

• The separate and joint analysis identified revealed several significant genomic associations with these traits

• Genetic variants of interest highlighted through the WGS analysis in several immune related genes for all the antibody response and parasitic infection traits

• Across-ecotype analysis resulted in moderate to high GEBV reliability (0.37–0.80) depending on the trait

• Genomic prediction accuracies from the across-ecotype analyses were not higher compared to within-ecotype
Identification of SNP Markers for Resistance to Salmonella and IBDV in Indigenous Ethiopian Chickens

August 2014
DOI: 10.13140/2.1.4230.3366
Conference: 10th World Congress of Genetics Applied to Livestock Production
Projects: Chicken Health for Development (CH4D) - Chicken Health for Development - Chicken Health and development

The role of local adaptation in sustainable production of village chickens

Nature Sustainability, Published: 15 October 2018

Integrating Genetic and Genomic Analyses of Combined Health Data Across Ecotypes to Improve Disease Resistance in Indigenous African Chickens

RESEARCH ARTICLE
Genome-wide association studies of immune, disease and production traits in indigenous chicken ecotypes

Nature Genetics, DOI: 10.1038/NG.3619
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Conclusions

• Genetic variation for immune, health and production traits

• Improvement of production and health traits simultaneously is feasible

Village chickens: a climate smart farming system

Village chickens are the preferable choice in Sub-Saharan Africa
Acknowledgements

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Thank you

www.ctlgh.org