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"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

Towards more efficient and sustainable production in Egyptian buffalo: The clue lies in the genome

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Abstract

The biodiversity and food security nexus is critical to ensure sustainable food production. Local livestock breeds, such as the Egyptian buffalo, play a vital role in providing animal protein to the local community. However, the potential of this species is often underestimated and underutilised due to the lack of national recording systems and insufficient pedigree information, which pose significant challenges for traditional breeding schemes. In addition, uncontrolled insemination with imported semen beside the current economic crisis, which led to a significant reduction in the number of Egyptian buffalo by 60 % in the last five years, put the genetic diversity and potential of this breed at risk. To address these challenges, we integrated genomic information into breeding evaluations for the first time in Egyptian buffalo. By genotyping hundreds of animals, we evaluated their production potential and established a basic population for more accurate prediction of economically important traits, e.g. milk production and composition. Our results demonstrated more reliable estimation of genetic parameters from a population with small size using a single-step genomic evaluation. The identified genomic regions harbor promising candidate genes with biological roles associated with milk production traits, e.g. POU2F1 on chromosome 6; TPD52, ZBTB10, RALYL and SNX16 on chromosome 15, ADGRD1 on chromosome 17, ESRRG on chromosome 5 and GRIP1 on chromosome 4. These findings provide useful information for exploring the genetic mechanisms underlying milk production traits and have significant implications for food security and small-scale farmers who own over 85 % of Egyptian buffalo. Integrating genomic information for genetic evaluation can play a critical role in achieving sustainable genetic improvement and preservation of the genetic diversity of this important breed. In conclusion, our work demonstrates the potential of integrating genomic information into selection decisions for Egyptian buffalo, even with a small sample size, to achieve more efficient and sustainable production while preserving genetic diversity.

Keywords: Egyptian buffalo, genomic evaluation, SNPs

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