

*Editorial*

## **Upgradation of cattle under smallholder farming system in Bangladesh: pros and cons**

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The smallholder dairy production under subsistence farming system is the backbone of dairy cattle industry in Bangladesh. According to the FAO (2022), 62% of livestock producers of Bangladesh rear cattle as a major livestock component, reflecting the importance of cattle to the rural economy and way of life. The total number of cattle in Bangladesh is about 24.86 million (DLS, 2023). There is no specialized dairy cattle breed in Bangladesh where the indigenous cattle are mostly used for both milk and meat production (Bhuiyan *et al.*, 2021). Despite having more animals per acre land than in other well-off countries, their production is often lower because of their poor genetic makeup, insufficient feed supplies, and lack of more systematic management (Bhuiyan, 2014; Hamid *et al.*, 2017). However, in order to fulfill the country's growing demand of milk and meat, dairy sector has undergone rapid transformation for production system, cattle genotypes and product marketing in Bangladesh and intensive production has been expanded by preferring improved and better performing upgraded dairy cattle.

Upgradation of indigenous cattle varieties has been practiced for the last five decades to boost up milk production through introduction of potentially higher yielding temperate (Holstein Friesian, Jersey) and tropical dairy breeds (Sahiwal, Sindhi). Meanwhile, a considerable number of crossbreds are discernible throughout the country owing to the upgradation activities operated by public-private stakeholders. The proposition of pure indicine and upgraded cattle is nearly 63:37 (DLS, 2019). In Bangladesh, Holstein-Friesian (HF) × Local (L) and Sahiwal (SL) × Local (L) are the most preferred upgraded cattle for dairy and beef operation, respectively. The genetic proposition of the resultant upgraded cattle could be classified broadly as 32.5%, 50.0%, 62.5%, 67.5%, 75%, 87.5% and even more based on their exotic inheritance. Studies shows that economically important productive and reproductive traits (birth weight of calf, daily milk yield, lactation length, age at first conception, days open and calving interval) differ significantly among the above mentioned different genetic groups of HF and SL derived upgrades (Khoda *et al.*, 2015; Hamid *et al.*, 2017). For instance, daily milk production of HF × L upgrades range between 4.0 to 25.0 liters (Azad *et al.*, 2023). More importantly, the increasing proportion of exotic inheritance may increase milk and meat production exponentially at the expense of reproduction and fitness traits in HF × L upgraded cattle of Bangladesh (Siddiquee *et al.*, 2014; Bhuiyan *et al.*, 2015).

The ongoing unplanned upgradation program has led to increase the proportion of graded animals exponentially at the expense of better adapted indigenous cattle of Bangladesh and thereby, the number has been decreased gradually (Siddiquee *et al.*, 2014; Azad *et al.*, 2023). There would a risk of extinction of indigenous cattle

genetic resources of Bangladesh in very near future if the existing situation prevails. On the other hand, the indiscriminate upgrading program has led to the production of a large number quasi animals with unknown breed composition and pedigree. Moreover, a substantial proportion of those upgraded genotypes are unexpectedly poor in performance and neither to achieve the target milk production nor has promise for development of synthetic dairy cattle line(s) suitable for hot and humid sub-tropical environment of Bangladesh. The upgradation of cattle under smallholder farming systems also has significant social and economic implications for rural communities in Bangladesh (Kabir *et al.*, 2018; Haque *et al.*, 2022). As small-scale farmers often rely on livestock for both income and subsistence, any changes to cattle production directly impact their livelihoods (Munsi *et al.*, 2017; Miah *et al.*, 2023). Improved cattle breeds with higher milk and meat yields can boost household incomes and contribute to poverty alleviation, but only if the upgraded cattle are well-suited to the farmers' available resources and local conditions (Hayrunnisa and Atasever, 2018). In many cases, smallholder farmers may lack access to the necessary inputs, such as high-quality feed, veterinary services, and technical support, which are critical for maintaining the health and productivity of upgraded cattle (Talukder *et al.*, 2017; Habib *et al.*, 2019). Additionally, the financial burden of investing in exotic or crossbred cattle can be prohibitive for many farmers (Matubber *et al.*, 2021). Ensuring that smallholder farmers have the knowledge, infrastructure, and support to manage upgraded cattle effectively is crucial for realizing the potential benefits of upgradation, while also minimizing risks of economic loss and strain on traditional farming practices.

Some notable limitations have been observed in the existing upgrading program such as absence of functional animal identification and registration system; lack of Herdbook or digital tool-based record keeping system, unavailability of sufficient information on pedigree, performance and genotype data for upgraded cows and bulls to be selected, indiscriminate breeding, unplanned admixture of different breeds without prior information and selection of phenotypically superior breeding bulls for artificial insemination (Bhuiyan *et al.*, 2015; Bhuiyan *et al.*, 2018). In fact, all rules and regulations regarding dairy cattle breeding are available only on papers, but not in practice. Importantly, phenotypic performance data coupled with genomic information would enable to overcome the current limitations of conventional upgrading program. The cutting-edge technologies like SNP genotyping or whole genome sequence information would provide excellent platform to detect genetic architecture, admixture scenario, genome wide association studies (GWAS), determine breeding worth of the upgraded animal as well as in precise animal selection process (Mehrban *et al.*, 2017; Bhuiyan *et al.*, 2021; Ekine-Dzivenu *et al.*, 2024). Taken together, the following issues like database establishment (both pheno and geno) at smallholder farmers level for genetic evaluation, predefined breeding between high merit bulls and cows with known genotype, minimize the number of upgraded genotypes, give emphasis on merit rather than the percentage of exotic inheritance of the animals, need to be addressed to get better performed and adaptive upgraded cattle in Bangladesh.

#### **Ethical approval and informed consent**

Not applicable.

#### **Data availability**

Not applicable.

#### **Conflict of interest**

None to declare.

#### **Author's contribution**

Conceptualization, formal analysis, writing-original draft preparation, review and editing: Mohammad Shamsul Alam Bhuiyan. The author has read and approved the final version of the published editorial.

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