EDITORIAL

Genetic Disorders and Control Strategies in Cattle Breeding

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Genetic diseases including monogenic and polygenic diseases are one of the most important issues in all animal species. However, the intensive use of individual sires in cattle breeding and the structure of bovine breeding programs make this species especially vulnerable to the effects of undesirable traits. It is obvious that such extensive use of a few elite sires may lead to dissemination of undesirable genes within a breed.

About 150 Mendelian diseases of cattle are thought to be caused by sequence variations in single genes, of which the causal mutations in less than half of them have been elucidated (http://omia.angis.org.au/home/). Bovine leukocyte adhesion deficiency (BLAD), deficiency of uridine monophosphate synthase (DUMPS), complex vertebral malformation (CVM), bovine citrullinaemia (BC) and factor XI deficiency (FXID) are autosomal recessive hereditary disorders, which have had significant economic impact on dairy cattle breeding worldwide. Breeding the animals carrying disease alleles is costly to the breeders. All of these diseases cause the economic loss but the economic impact of them vary in the amount of loss. For these inherited diseases, the characteristic feature of autosomal recessive genes is that they are only expressed as a diseased phenotype if both alleles are present. When a carrier bull and a carrier cow are bred together, and then you are likely to get the unaffected cattle 25% of the time, the carrier cattle 50% of the time, and an affected animal 25% of the time. For that reason, the carrier animals must be identified in herd. Heterozygous individuals can be identified by different methods such as examination of progeny e.g. by clinical examination or necropsy, analysis of enzyme activity in blood, and genotyping of animals by genomic analysis. Recent developments within molecular genetics have made possible efficient and rapid identification of heterozygous animals by genomic analysis. Knowing the molecular basis of a defect, the direct detection of carriers is possible at the genetic level, thus preventing unintended breeding of the animal (Agerholm 2007, Windsor and Agerholm 2009; Meydan et al. 2009, 2010).

The knowledge of the molecular genetic basis of livestock diseases has offered geneticists and breeders new opportunities of tackling these diseases safely and cheaply. Genetic control of diseases that are under the control of single genes such as BLAD, DUMPS, CVM, BC, and FXID is easily achievable. It is strongly advised fast and effective identification of bulls or semen samples by molecular techniques (PCR-based tests e.g.) to ensure the utilization of bulls free from genetic disorders for especially artificial insemination programs to eliminate these genetic disorders, and therefore, prevent economic loses. Using this method, several of these diseases have been successfully controlled or eliminated from the herd. Someone wants to keep the carrier cattle in herd. Then they must make sure that carrier bulls and cows are never bred together. All economically important bulls used in artificial insemination are tested for these genetic disorders and someone can get the results from the worldwide breed association. At present, there are identification records for several inherited bovine disorders which are economically important such as BLAD, DUMPS, CVM, BC, and FXID.

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