Phenotypic variation of milk antioxidant activity in Italian Mediterranean buffaloes

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This study evaluated the phenotypic variation of milk antioxidant activity in 849 Italian Mediterranean buffaloes using Total Antioxidant Capacity (TAC), and Ferric Reducing Antioxidant Power (FRAP).

Data were collected from 19 farms in Southern Italy, between December 2021 and December 2023. They included animal characteristics, milk quality traits, and the chemical composition of the diets provided to the animals. At each farm, visits were scheduled in advance to ensure that the sampled animals were balanced in terms of DIM and parity. Linear mixed models were applied to assess the effect of parity, sampling season, milk production level, days in milk (DIM) and farm on TAC and FRAP. Since farm significantly contributed to TAC and FRAP variability ($P<0.05$), we investigated whether dietary composition could partially explain this effect. Two Random Forest classification models were developed separately for TAC and FRAP. Animals were ranked according to their phenotypic values of TAC and FRAP, and the 100 highest and 100 lowest individuals for each trait were selected to define high and low antioxidant activity classes, respectively. Chemical dietary variables were then used as predictors in the classification models and variable importance was evaluated using the Mean Decrease Gini (MDG).

Neither TAC nor FRAP differed across parity, sampling season or milk production classes ($P>0.05$). In contrast, DIM significantly affected TAC, which increased from 149 to 163 nmol/Trolox as lactation progressed. Classification accuracy of random forest model was 0.80 for FRAP and 0.78 for TAC. Acid detergent fibre exclusive of ash (ADFom) and cellulose were the most relevant dietary variables influencing both TAC (MDG=2.61 and 2.59) and FRAP (MDG=3.88 and 2.88). Overall, milk antioxidant activity was primarily associated with farm-related effects rather than intrinsic animal characteristics. The variability explained by farm and dietary fibre fractions suggests that TAC and FRAP can be influenced by nutritional and management factors that can be considered as valid approaches to act on the antioxidant capacity in Italian Mediterranean buffaloes.