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Impact of weather changes on milk production and fat percentage of milk in Holstein cattle in Mediterranean climate of Iran

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Abstract

Ignoring genotype by environment interaction ($G \times E$) may affect the efficiency of breeding strategies. Quantifying the effects of $G \times E$ for farms with different management and climate conditions is therefore necessary. In this respect, the objective of this research was to investigate the impact of temperature-humidity Index (THI) as an environmental descriptor for heat stress on milk yield (MY) and fat percentage (FP) of Holstein dairy cattle in Mediterranean climate of Iran. The first lactation information of 42781 and 38829 cows with 348868 and 302851 records respectively for MY and FP were considered. The average of daily THI for 3 days before test date was used as an environmental factor which calculated using information of the nearest weather stations to each herd. (Co)variance components were estimated using Bayesian methodology via random regression model (RRM) for different combinations of THI and days in milk (DIM). As a function of DIM, for MY, the additive genetic variances increased from 0.05 in early lactation to 7.3 at the end of the lactation. For FP, the high values of genetic variances were estimated for early lactation stage. As a function of THI, for MY, the highest additive genetic variance was 6.8 for the lowest THI (35) value and for FP, the lowest and the highest variances were 0.38 and 1.25 for THI values of 35 and 64, respectively. For both traits, heritabilities varied across different combinations of $DIM \times THI$. For both DIM and THI values, the genetic correlations gradually decline as the distance between values increases. It is evidence that different records along the different THI values like DIM are affected by different genes. In this regard, the estimated genetic correlations for FP were lower than corresponding correlations for MY. Therefore, more considerable indication for $G \times E$ existence was found for FP. In addition, for both traits, negative genetic trends across THI values were observed. It could be concluded that heat stress considered to be adversely impacting both traits and the overall idea of this research on heat stress indicates the need to model an additive genetic effect for heat tolerance of dairy cattle herds in Mediterranean climate of Iran.

Key words:

Heat stress; Genotype by Environment Interaction; Dairy Cattle; Heritability; Genetic Trend