Impact of different fixed effects on breeding value prediction and accuracy for in vitro embryo production

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In vitro embryo production (IVEP) is an important tool for increasing reproductive and productive gains in cattle, as it allows for the multiplication on a larger scale of females with high genetic merit. The objective was to verify whether the estimeted breeding value (EBV) and their accuracy (ACC) for IVEP traits in Gir Dairy cows change according to the different effects included in the prediction model. We used 12,922 observations of cleaved embryo (CE) and viable embryo (VE) production counts from 3,052 cows kept on three farms in the state of Minas Gerais, collected between 2007 to 2017. Twelve models were evaluated, which differed in terms of the type of bull effect (1 - not included; 2 - simple fixed; and 3 - random), type of age at collection (1 - simple fixed; and 2 - fixed as a covariate: linear and quadratic) and contemporary group formation criteria (1 - including the effects of herd, year and season of collection; and 2 - effects of herd and year of collection, with the season of collection included as a separate fixed effect). First, EBV and ACC values were obtained using software from the BLUPF90 family. The best-fit models were chosen using the Akaike information criterion, which indicated model-12 for CE, which included the effect of bull (3), age at collection (2) and contemporary group (2), and model-3 for EV, which considered the effect of bull (3), age at collection (1) and contemporary group (1), and these models were used to obtain the 5% best males (5%M) and 20% best females (20%F). Finally, Spearman's correlation (ρ) was calculated between EBV and ACC for CE and EV, respectively. For CE (model-12) the lowest correlations between EBV were obtained with model-2, for the 5%M (ρ = 0.5715) and for the 20%F with model-1 (ρ = 0.7175), where only the formation of the contemporary group was similar between these models. Model 6 showed the highest correlation with model 12 (5%M = 0.9885 and 20%F = 0.9927, respectively), with the effects of bull and age at collection being the same and only the formation of the contemporary group differing. For EV (model-3), the lowest correlation between the EBV was observed with model-4 (ρ = 0.8198) for the 5%M and for the 20%F it was with model-10 (ρ = 0.8300), where only the contemporary group was common between these models. As expected, the highest correlation between EBV for EV (model-3) was with model-9 (5%M = 0.9874 and 20%F = 0.9913, respectively), which differed only in the formation of the contemporary group, with the effects of bull and age at collection being the same. The correlations between the ACC values of model 12 (CE) and 3 (EV) and the other models were positive and close to one, ranging from 0.985 to 1 (CE) and 0.998 to 1 (EV), with no difference between males and females. It is therefore expected that there will be no change in ACC values according to the models. In relation to the EBV, it is expected that there will be a change in the classification of the animals with the inclusion of different types of effects and the formation of contemporary groups, with the absence of the bull effect and the inclusion of age at collection as a fixed factor providing lower correlations between the classification of the animals.

Keywords: ambiental factors, Gir dairy, Spearman's correlation, viable embryos