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Bull individual effect is determinant to *in vitro* embryo production regardless of seminal profile

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Bull fertility is an intriguing issue of animal reproduction and so far, different groups have tried to characterize which sperm traits contributes to fertilize and sustain embryo development. In addition, the difference between *in vivo* and *in vitro* system turns difficult to extrapolate the results from the field to the laboratory. Then, the aim of this study was to create a model with flow cytometry and computer assisted sperm analysis (CASA) to identify which sperm traits contribute and how much they contribute to create a predictive model of *in vitro* fertility. For that, we produced a database of in vitro embryo production (IVP) of 51 semen batches from 23 Nelore bulls. For each batch, at least 3 IVP manipulations were performed, in total of 184 IVP manipulations, collecting sperm traits analysis by the *in vitro* fertilization step, after Percoll® gradient selection and embryo production rates (cleavage and blastocyst rates). Sperm traits evaluated by flow cytometry were acrosome and membrane integrity (FITC-PSA/PI), mitochondrial membrane potential (JC-1) and chromatin integrity (modified SCSA) and CASA parameters related to total and progressive motility, movement kinetics and velocities were recorded. Twenty-two sperm traits, cleavage rate and bull individual effect were included to build a mathematical model, considering the blastocyst rate as predictor of the in vitro bull fertility. Statistical analysis was performed using the SAS 9.4 Software with the GLM model, and the selection of the variables was performed through the Forward Selection. The adjusted coefficient of determination (ADJRSQ; R2) and p-value $\leq$ 0.5 were used as criteria for model acceptance. Between all variables included to predict blastocyst rate, bull and cleavage rates were those, which presented higher F values and then better indicators of embryo production. The best predicted model achieved for blastocyst rate included the percentage of total motility, the percentage of static sperm, cleavage rate and the bull individual effect ($p<0.0001$ and Adj R-Sq = 0.6319): Blastocyst rate (%) = - 1.2382(Intercept) + Bull + 0.1229*(total motility) + 0.0667*(Static) + 0.4494*(cleavage rate). Our results indicated that the bull individual effect is one of the most determining factors for IVP outcome. This effect, carried by the sperm produced by these animals will directly affect blastocyst rate. The assessment of sperm traits is an attempt to explore such bull individual effect. However, none of the 22 sperm attributes analyzed alone or in combination can explain a significant part of this bull effect on blastocyst rate. Then, our results indicate that bull individual effect, which is probably independent from the different sperm traits analyzed, is the strongest effect to define the IVP rates. Further studies focusing on sperm nuclear proteins, micro RNAs and metabolism may enlighten the knowledge on such bull individual effect. Financial Support: FAPESP (n° 2016/15147-5)