European Pharmacopoeia potency test for FMD vaccine: The influence of adjuvant, culture, serotype, valency and method of potency trial on dose-response curve

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Introduction: Foot-and-mouth disease vaccine release in Europe is based on the potency test described in European Pharmacopoeia. The objective of this paper was to estimate the relationship between vaccine potency and fraction of cattle protected, and to determine whether this relationship was influenced by serotype, type of adjuvant and culture, valency and method of potency trial.

Materials and Methods: Data of 295 potency tests performed in cattle were available from the vaccine production facilities in Lelystad. Multivariable logistic regression analysis was used to determine the relationship between the fraction of cattle protected against challenge and the logarithm of the dose. We tested whether type of adjuvant, culture type, valency, serotype and method of potency trial significantly influenced the relation between fraction protected and the logarithm of the dose.

Results: A highly significant (P < 0.001) relationship was found between logarithm of the dose and fraction of cattle protected. The type of culture did not significantly affect the steepness of the dose-response curve (P > 0.05). A highly significant influence (P < 0.01) of method of potency trial, serotype, type adjuvant, and valency of the vaccine on the steepness of the dose-response curve was observed. The model predicts an almost horizontal dose-response curve if oil emulsion vaccine would be diluted first in adjuvant and the second step in buffer. If trivalent aluminium hydroxide adjuvanted vaccine was tested for protection against a type C challenge using reduction of volume in the potency trial, the dose equal to six times the dose that protects 50% of the cattle (PD₅₀) would protect approximately 98% of the cattle.

Discussion: The results show that the fraction of protected cattle induced by a vaccine is not only related to the amount of PD₅₀ in the vaccine, but also on method of potency trial, serotype, type of adjuvant and valency of the vaccine. The potency of a vaccine is better represented by the estimation of fraction protected animals than the amount of PD₅₀, which makes it also easier to replace potency tests by serological tests.