A simplified model for the characterization of blood alcohol elimination

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Abstract:

The model typically used to describe the elimination of alcohol concentration in humans assume a zero-order kinetics, that is, the alcohol is eliminated with a constant rate. However, it does not consider the absorption phase in which the alcohol concentration increases to reach a certain maximum peak. Some alternative models including both phases have been already studied, among them are the compartmental systems and the gamma distribution model.

In this work, a simplified model like the last one is proposed in order to be easy-to-use for the non-statistician community, such as forensic scientists. Optimal designs have been computed for this model, and compared with existing designs found in literature. In addition, equally spaced designs were studied, since this type of designs are usually preferred by experimental practitioners who would rather to take samples covering the whole design interval instead of restricting themselves to the fewer points contained in the optimal designs. Efficiencies of these designs with respect to the optimal ones have also been computed. In this setup, it will be necessary to assume a covariance structure between responses, however the case of independent observations has also been considered in order to be able to compare the results with those in works existing in literature.

Keywords: Optimal design of experiments, D-optimality, ethanol, Widmark