In many studies, flight initiation distance (FID, the distance at which a prey starts to flee at the approach of a walker) is positively related to starting distance (SD, the distance at which the walker begins to approach) and alert distance (AD, the distance at which the focal individual becomes alert to the threat). In spite of the fundamental differences between SD, a covariate that may not have any biological effect, and AD, a measure related to the behaviour of the animal, it is common to use SD as a proxy for AD when AD is hard to measure (e.g. in species that do not exhibit distinguishable alert postures). However, the relationship between SD and AD or FID may not have any biological reasons, but may instead simply result from a mathematical artefact because of the constraints $SD \geq AD \geq FID$. Under such constrains, the homoscedasticity assumption is violated, and thus, the classical null hypothesis of linear regression (slope = 0) is invalid. In this study, we first show that using SD as a proxy for AD can strongly affect the results on FID. Using data from FID tests on alpine marmots (Marmota marmota), a linear mixed model with AD as a covariate, suggested that the interaction between previous activity and AD had an effect on FID, while this effect was not detected when SD replaced AD as the covariate in the analysis. We then propose that the actual statistical test of the relationship between SD, AD and FID should be based on a null hypothesis that incorporates the constraint $SD \geq AD \geq FID \geq 0$ and generate 95% CI of simulated slopes obtained from random values under this constraint. This null hypothesis can be rejected if the observed slope of the relationship between two of these variables is outside the 95% CI. We demonstrated that, for alpine marmots, the observed slope of the relationship between AD and SD was within the 95% CI of the simulated slopes. The absence of a statistically significant biological effect in the relationship between SD and AD raises important questions on the outcome of relationship between SD and FID. In Alpine marmot flight, decision should be studied separating the effect of SD on AD and the effect of AD on FID.

http://onlinelibrary.wiley.com/doi/10.1111/eth.12006/abstract