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Tales of significance

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Abstract

In this experiment, the authors were interested in testing the effect of a small molecule inhibitor on the ratio of males and females in the offspring of their model Dipteran species. The authors report that in a wild-type population, ~50 % of offspring are male. They then test the effect of treating females with the chemical, which they think might affect the male:female ratio compared with the untreated group. They claim that there is a statistically significant increase in the percentage of males produced and conclude that the drug affects sex ratios.

Commentary

Previous examples in this series have drawn attention to some problems with *p* values and statistical significance. Choosing the right test to use to analyse data is another area of possible confusion. In this case, the conclusion that the drug causes a statistically significant difference is not supported by the data because the authors used an inappropriate statistical test in their analysis. Their hypothesis was that there would be a change in the ratio of the sexes, but in either direction—either more males or fewer males. In that case, a two-tailed test is needed. However, the two-tailed test did not reach statistical significance. The authors then used a one-tailed test in order to test the hypothesis that the drug increased the percentage of males born; this gave a *p* value of <0.05, which the authors indicate in the work (Fig. 1).

A one-tailed test is used to determine if there is a difference in the means in one direction only (more males; or fewer males; but not either outcome); because of this, one-tailed *p* values are half of the two-tailed value in most statistical tests and reach statistical significance faster than two-tailed counterparts. Though there is nothing wrong with using a one-tailed test in principle—if there is a good reason to assume the difference in means would be in one direction only—the authors erred in their initial choice and also should not change the test post hoc.

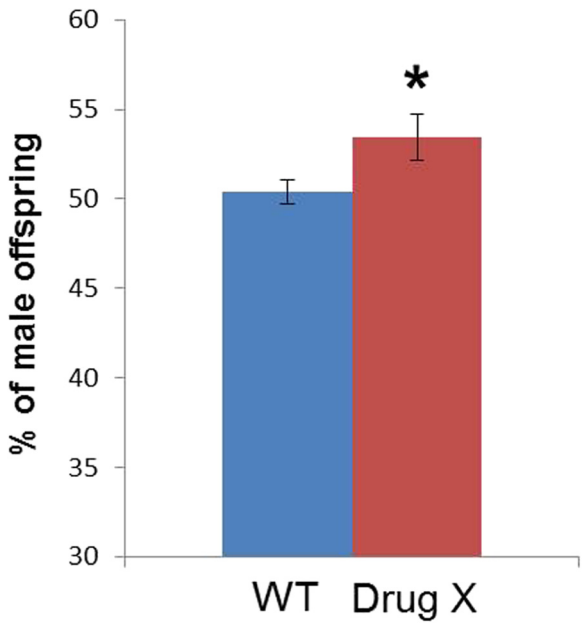

Fig. 1. The percentage of male offspring produced by untreated (*WT*) flies or female flies treated with drug X. *$P < 0.05$, one-tailed t-test, error bars show SD

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