

HYPOTHESIS TESTING

The steps illustrated here apply to any hypothesis test: Z, T, F, Chi-Square, etc. For sake of demonstration we will use the T-test to demonstrate a proper hypothesis test.

Problem: Taurine is an important protein for cats, but since they cannot naturally manufacture it, they must be fed a diet that includes taurine. The following data is given for plasma taurine readings on cats on dry vs. wet food at 10 weeks. The mean for dry food cats was 103 mg of taurine per kilogram with a standard deviation of 34 mg/kg; for wet food cats the mean was 123 mg taurine per kilogram, $sd = 57$ mg/kg. There were 8 cats used in both trials. At the $\alpha=0.05$ level of significance, is there a difference in taurine levels between wet and dry food? (Data: Douglass et al, Feline Plasma and Whole Blood Taurine Levels as Influenced by Commercial Dry and Canned Diets, J Nutrition, 1991)

STEP 1: State the claim in English as clearly as possible:

CLAIM: Dry and wet cat food differ in the amount of blood plasma levels.

STEP 2: Rewrite the claim as a hypothesis. Determine the number of tails, if applicable.

$$H_0 : \mu_1 - \mu_2 = 0$$

$$H_a : \mu_1 - \mu_2 \neq 0$$

This is a two-tailed test since it is significant both ways: the difference in mean can be either greater or lesser than the other. Since we care if they are different, we want to examine both tails. Hence, a two-tailed test.

STEP 3: Gather your data for analysis, and decide on appropriate test

$$\text{Dry: } \bar{x}_1 = 103 \text{ mg taurine/kg} \quad \text{Wet: } \bar{x}_2 = 123 \text{ mg taurine/kg}$$

$$s_1 = 34 \text{ mg taurine/kg}$$

$$s_2 = 57 \text{ mg taurine/kg}$$

$$n = 8$$

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$$\text{degrees of freedom} = n-1 = 7$$

$$df = 7$$

Since there is a small number in the sample and σ is not known, a two-sample T-test should be used.

STEP 4: Determine critical value. (This can be skipped if the data is to be evaluated using P-values.)

From a standard T-table: $T_{\text{critical}} = \pm 2.84$ for 7 degrees of freedom.

STEP 5: Run test and compare to critical values

We will use the two-sample T-test equation (2SampTTest on TI calculator) to find:

$$T_{\text{value}} = 0.852, \text{ which is less than the critical value}$$

STEP 5 alternative: Compare the p-value of the test to $\alpha/2$:

p-value is the probability of getting our $T_{\text{value}} = 0.852$. Using a T-table to find p-value associated with 0.852:

$$\text{p-value} = 2(0.0408) = 0.0816 > \alpha$$

STEP 6: Write conclusion as clearly as possible:

Since our test value is less than our critical value (alternatively, p-value is greater than 0.05), we fail to reject H_0 . Our data does not support the claim that there is a difference in taurine plasma levels for cats on wet vs. dry food.