CASE : Comparison of Nutritive Values of Corn Diets

Plant scientists have developed varieties of corn that have increased amounts of the essential amino acid lysine. In a test of the protein quality of this corn, an experimental group of 20 one-day-old male chicks was fed a ration containing the new corn. A control group of another 20 chicks received a ration that was identical except that it contained normal corn. Below and in CORN.MTW are the weight gains (in grams) after 21days. (Based on G. L. Cromwell et al., "A comparison of the nutritive value of *opaque-2*, *floury-2* and normal corn for the chick," *Poultry Science*, 47 (1968), pp. 840–847.)

Control				Experimental			
380	321	366	356	361	447	401	375
283	349	402	462	434	403	393	426
356	410	329	399	406	318	467	407
350	384	316	272	427	420	477	392
345	455	360	431	430	339	410	326

Two-Sample t – Test

Unknown population standard deviations

The null hypothesis is that both population means μ_1 and μ_2 are equal, thus their difference is equal to zero.

H_0: $\mu_1 = \mu_2$

with either a one-sided or a two-sided alternative hypothesis.

H_a: $\mu_1 \neq \mu_2$

(or $\mu_1 > \mu_2$ or $\mu_1 < \mu_2$)

Test Statistic:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

~ (approx.) t(df) if H_0 is true

$1 - \alpha$ Confidence Interval:

$$\bar{x}_1 - \bar{x}_2 \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Degrees of Freedom for the Two-Sample *t*-Test

The **best approximation of the degrees of freedom** for a two-sample *t*-distribution is quite lengthy to calculate.

$$df = \frac{\left(\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}\right)^2}{\dfrac{1}{n_1 - 1}\left(\dfrac{s_1^2}{n_1}\right)^2 + \dfrac{1}{n_2 - 1}\left(\dfrac{s_2^2}{n_2}\right)^2}$$

Computer software will apply this formula. A conservative approximation suitable for hand calculations is:

$$df = \min(n_1 - 1, n_2 - 1)$$

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Control: $\bar{x}_1 = 366.30$ $s_1 = 50.80$

Experimental: $\bar{x}_2 = 402.95$ $s_2 = 42.73$

Pooled Two-Sample t – Test

Unknown population standard deviations but $\sigma_1 = \sigma_2$

The null hypothesis is that both population means μ_1 and μ_2 are equal, thus their difference is equal to zero.

H_0: $\mu_1 = \mu_2$

with either a one-sided or a two-sided alternative hypothesis.

H_a: $\mu_1 \neq \mu_2$

(or $\mu_1 > \mu_2$ or $\mu_1 < \mu_2$)

Test Statistic:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

~ (approx.) t(df) if H_0 is true

$$s_p^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} =$$

$$df = n_1 + n_2 - 2$$

CASE : Comparison of Nutritive Values of Corn Diets

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