

ANOVA Exercises

A sample of 20 different types of cereals was taken from each of three grocery store shelves (1, 2, and 3, counting from the floor). A summary of the sugar content (grams per serving) and dietary fiber (grams per serving) of the cereals is given below.

	N	Sugar		Fiber	
		Mean	SD	Mean	SD
Shelf #1	20	4.80	2.138	1.68	1.166
Shelf #2	20	9.85	1.985	0.95	1.162
Shelf #3	20	6.10	1.865	2.17	1.277

- Test for significant differences in sugar content among the three shelves.
 - Assess whether or not the data meet the assumptions necessary for an ANOVA.
 - Construct an ANOVA summary table and find the observed mean square ratio.
 - Compare the observed mean square ratio to its appropriate test statistic
 - State your conclusion (explain what rejecting or retaining the null hypothesis means)
 - According to your results, which shelf displays the cereals with the highest sugar content?
 - Calculate the effect size ($\eta^2 = SS_A / SS_T$) and explain what it represents.
- Test for significant differences in fiber content among the three shelves.
 - Assess whether or not the data meet the assumptions necessary for an ANOVA.
 - Construct an ANOVA summary table and find the observed mean square ratio.
 - Compare the observed mean square ratio to its appropriate test statistic
 - State your conclusion (explain what rejecting or retaining the null hypothesis means)
 - According to your results, which shelf displays the cereals with the highest fiber content?
 - Calculate the effect size ($\eta^2 = SS_A / SS_T$) and explain what it represents.
- A factory has three production lines producing glass sheets that are all supposed to be of the same thickness. A quality inspector takes a random sample of $n = 30$ sheets from each production line and measures their thickness. The glass sheets from the first production line have a sample mean of 3.015 mm with a sample standard deviation of 0.107 mm. The sample mean and standard deviation of the second production line are 3.018 mm and 0.155 mm. The third production line produced glass with a mean of 2.996 mm and a standard deviation of 0.132 mm. What conclusions should the quality inspector draw? Calculate the effect size ($\eta^2 = SS_A / SS_T$) and explain what it represents.
- The presence of harmful insects in farm fields is detected by erecting boards covered with a sticky material and then examining the insects trapped on the boards. To investigate which colors are most attractive to cereal leaf beetles, researchers placed six boards of each of four colors in a field of oats in July. Using the data in the following table, what conclusions can you draw? Calculate the effect size ($\eta^2 = SS_A / SS_T$) and explain what it represents.

	Number of Insects Trapped						Mean	Std. Dev.
	45	59	48	46	38	47		
Yellow	45	59	48	46	38	47	47.167	6.795
White	21	12	14	17	13	17	15.667	3.327
Green	37	32	15	25	39	41	31.500	9.915
Blue	16	11	20	21	14	7	14.833	5.345

5. Complete the following ANOVA summary tables. Conduct the significance test and calculate the effect size ($\eta^2 = SS_A / SS_T$) for each table.

Source	SS	df	MS	MSR
Groups		3	158.96	
Error		32	62.81	
Total				

Source	SS	df	MS	MSR
Groups		7		5.01
Error			3.62	
Total		29		

6. The effect of caffeine levels on performing a simple finger-tapping task was investigated. 30 male college students were trained in finger tapping and randomly assigned to receive either 0, 100, or 200 mg of caffeine. Two hours later, the students were asked to finger tap and the number of taps per minute was counted. What conclusions can you draw from this data (using SPSS as a class). If the differences among groups are statistically significant, are they also of practical significance?

Caffeine	Taps per minute	Mean	Std. Dev.
0 mg	242 245 244 248 247 248 242 244 246 242	244.8	2.394
100 mg	248 246 245 247 248 250 247 246 243 244	246.4	2.066
200 mg	246 248 250 252 248 250 246 248 245 250	248.4	2.214