SPSS: k Between Groups ANOVA & Post Hoc Tests

Application: To compare means of a quantitative variable obtained from 2 or more independent groups.

Research Hypothesis: The researcher hypothesized that Coop stores would have the most fish on display, Chain stores would display the least, and Private pet stores would display an intermediate amount.

H0: for this analysis: The three different types of pet shops have the mean number of fish displayed.

Analyze → General Linear Model → Univariate

- highlight the "Dependent" variable (be sure it is **guantitative**) and click the arrow •
- highlight the "Factor" (IV, grouping) variable (be sure it is qualitative) and click the arrow •
- "Options" check that you want "Descriptive Statistics •
- "Post Hoc" highlight the factor and click the arrow •

Univariate Univariate Univariate Univariate University of reptile depart University of reptile quali University of reptiles a University of reptiles a University of reptiles a University of reptiles a University of reptiles a	Dependent Variable: Model Contrasts Fixed Factor(s): Plots Post Hoc
 Paing of reptile qual number of reptiles a type of fish available rating of fish quality number of mammal 	 Image: A start of store [chain] Image: A
OK E	aste <u>R</u> eset Cancel Hep

SPSS Syntax

UNIANOVA fishnum BY chain /METHOD=SSTYPE(3) /POSTHOC=chain(TUKEY LSD) ← IV & enter Post Hocs /PRINT=DESCRIPTIVE /CRITERIA=ALPHA(.05).

- ← DV "by" IV
- \leftarrow appropriate for =/n
- ← get descriptive stats
- ← sets p-value for the Post hoc tests

Estimated Marginal Means Factor(s) and Factor Interactions (OVERALL) chain	Display Means for:
	Compare main effects Confidence interval adjustment LSD(none)
Display	
Descriptive statistics	Homogeneity tests
Estimates of effect size	Spread vs. level plot
Observed power	Residual plot
Contract coefficient matrix	General estimable function
Univariate: Post Hor Multiple Com	Cancel Help
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Please Note: You can also perform this analysis using the "ONEWAY" procedure we used for the 2 BG ANOVA. It has the same post hoc analysis choices and produces equivalent output.

Descriptive Statistics

Dependent Variable:number of fish at store

type of store	Mean	Std. Deviation	N
chain store	17.40	5.030	5
privately owned	19.33	4.041	3
соор	35.50	4.796	4
Total	23.92	9.605	12

Tests of Between-Subjects Effects

Dependent Variable number of fish at store

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	812.050 ^a	2	406.025	18.013	.001
Intercept	6660.835	1	6660.835	295.502	.000
chain	812.050	2	406.025	18.013	.001
Error	202.867	9	22.541		
Total	7879.000	12			
Corrected Total	1014.917	11			

a. R Squared = .800 (Adjusted R Squared = .756)

Multiple Comparisons

number of fish at store LSD

					95% Confidence Interval		
(I) type of store	(J) type of store	Mean Difference (I- J)	Std. Error	Sig.	Lower Bound	Upper Bound	
chain store	privately owned	-1.93	3.467	.591	-9.78	5.91	<
	coop	-18.10*	3.185	.000	-25.30	·10.90	<
privately owned	chainstore	1.93	3.467	.591	-5.91	9.78	
	coop	-16.17*	3.628	.002	-24.37	-7.96	
coop	chainstore	18.10	3.185	.000	10.90	25.30	
	privately owned	16.17*	3.628	.002	7.96	24.37	

Based on observed means. The error term is Mean Square(Error) = 22.541.

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*. The mean difference is significant at the .05 level.

Multiple Comparisons

number of fish at store TukeyHSD

					95% Confidence Interval	
(I) type of store	(J) type of store	Mean Difference (I- J)	Std. Error	Sig.	Lower Bound	Upper Bound
chain store	privately owned	-1.93	3.467	.845	-11.61	7.75
	coop	-18.10*	3.185	.001	-26.99	-9.21
privately owned	chain store	1.93	3.467	.845	-7.75	11.61
	coop	-16.17	3.626	.004	-26.29	-6.04
coop	chain store	18.10	3.185	.001	9.21	26.99
	privately owned	16.17*	3.626	.004	6.04	26.29

Based on observed means. The error term is Mean Square(Error) = 22.541.

*. The mean differenc∈ is significant at the .05 level.

Usually, but not always, results from LSD & HSD analyses agree. When they don't the source of the disagreement is usually that the study is "underpowered" for the HSD. A sample size providing adequate power to reject H0: using the more sensitive LSD may not provide adequate power to reject H0: using the more conservative LSD. This most likely to happen when the sample size is selected based on p<.05, and then the HSD is applied.

Remember, even if the printout shows it, never report p = .000, because that would suggest there is no possibility of a Type 1 error. Instead, report "p < .001"

The p-value of .001 means that there is about a .1% chance that this result is a Type I error

Notice that each pairwise comparison is presented twice!

Chain vs Private = Private vs Chain

Be sure you get the direction of each significant mean difference right!!

- Chain = Private
- Chain < Coop</p>

Private < Coop</p>

These LSD p-values can also be used for Bonferroni tests. Had we been interested in only the comparison of Chain v Private & Private v Coop, we would want to test each using p = .05 / 2 = .025.

Notice that each pairwise comparison is presented twice!

Chain vs Private = Private vs Chain

Be sure you get the direction of each significant mean difference right!!

Chain = Private Chain < Coop Private < Coop

Post Hoc "Computators"

SPSS does not provide post hoc analyses for all ANOVA models (e.g., WG designs). Also, there may be occasions when you want to compare means from a study that didn't post analyses, or did them differently than you would have preferred. One additional advantage of using these is that you can provide your readers with the LSD or HSD values that were the basis of your post hoc tests.

http://psych.unl.edu/psycrs/statpage/escomp.exe http://psych.unl.edu/psycrs/statpage/computator_131a.xls



The two Computators will produce slightly different results, and those results might be slightly different from the SPSS results, because they all use slightly different t-table values and Student's t-table values. The specific table (with the applied sample size rounding) can be seen for the xls version if you extend the right side of the spread sheet.

Applying these L	.SD	/HSD values to the pairwise cor	nparisons Chain = 17.40	Private = 19.33	Coop = 35.50
Pair	→	Chain v Private	Chain v Coop	Private v Coop	
Mean Difference	→	1.93 <	18.10 <	16.17 <	
LSD Result	→	=	<	<	
HSD Result	→	=	<	<	
RH:		The researcher hypothesized that the least, and Private pet stores w	Coop stores would have the mos ould display an intermediate amo	t fish on display, Cha unt.	in stores would display
	→	<	<	<	
RH: support?	→	Not supported	Supported	Supported	Partial Support

Reporting the Results

The number of fish displayed at each type of store is summarized in Table/Figure 1. There were significant mean differences in the number of fish displayed among the three types of stores, F(2,9) = 18.01, Mse = 22.54, p <.05. Pairwise comparisons using LSD (with a minimum mean difference = 7.59) revealed that, consistent with the research hypothesis, Coop stores displayed more fish than either Private or Chain stores. However, contrary to the research hypothesis, there was no difference between the average number of fish displayed by Chain and Private pet stores.