SPSS for 1-Factor ANOVA

I. Data File Format

- need two columns; one for the independent variable (i.e., contains treatment group designations for each replicate) and one for the data for each replicate. See the data file example below, where: column 1 = Factor; column 2 = data.

1	7.00
2	5.30
3	4.90
1	8.80
2	9.90
3	10.4
	etc….

II. Model I Analysis

(1) From the pull-down menu:
Analyze → General Linear Models → Univariate <click on this>

(2) Specify dependent and independent variables:
- highlight the variable of interest in the left window menu, then click on the appropriate arrow to define the DEPENDENT VARIABLE, and do the same for the INDEPENDENT VARIABLE, which should be FIXED.

(3) Specify follow-up procedures for ANOVA, either Post-hoc test OR Contrast (but not both):

(a) Post-hoc tests:

- click on "Post-hoc" button in main GLM menu. Click on the independent variable name in the top left window, then the arrow to move it into the "Post-hoc tests for" window. Now select (by clicking in box next to each name) which post-hoc test you wish to perform. Click on "Continue" button to return to main menu.

(b) Contrasts:

- click on "Contrasts" button in main GLM menu. Click on arrow in bottom menu to reveal the four standard contrasts available. Select one by clicking on it, then click on the "Change" button. Click "Continue" button.

(4) Add assumption checking commands if you wish (see below). Click "OK" button when ready to run the test.

III. Model II Analysis

PART I; GETTING THE ANOVA TABLE:

(1) From the pull-down menu:
Analyze → General Linear Models → Univariate <click on this>

(2) Specify dependent and independent variables:
- highlight the variable of interest in the left window menu, then click on the appropriate arrow to define the DEPENDENT VARIABLE, and do the same for the INDEPENDENT VARIABLE, which should be RANDOM.

(3) Add assumption checking commands if you wish (see below). Click "OK" button when ready to run the test.

PART II; GETTING VARIANCE COMPONENTS:

(1) From the pull-down menu:
Analyze → General Linear Models → Variance Components <click on this>

(2) Specify dependent and independent variables:
- highlight the variable of interest in the left window menu, then click on the appropriate arrow to define the DEPENDENT VARIABLE, and do the same for the INDEPENDENT VARIABLE, which should be RANDOM. Click "OK" button when ready to run the test.

IV. Checking Assumptions & Obtaining Descriptive Statistics within GLM test procedure:

(1) If you have not yet checked assumptions using the EXPLORE procedure, you can also do so here. When running one of the tests above and after you have specified your dependent and independent variables, click on "Options" button. Then click on independent variable name, then arrow to move it into the "Display means for" window.

(2) Now select (by clicking box next to each procedure) from the list at the bottom whatever procedures that you wish to perform. Some you may find useful include: "Descriptive Statistics", "Homogeneity tests", "Spread vs. level plot", and "Residual plot". When done, click "Continue" to return to the main GLM menu.

V. Model I ANOVA Output:

Between-Subjects Factors

		N
fat	1	9
	2	9
	3	8

Descriptive Statistics

Dependent Variable: SPVOL

fat	Mean	Std. Deviation	N
1	5.889	.8054	9
2	6.311	.7253	9
3	7.300	.9754	8
Total	6.469	.9967	26

Levene's Test of Equality of Error Variances[a]

Dependent Variable: SPVOL

F	df1	df2	Sig.
.205	2	23	.816

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+FAT

Tests of Between-Subjects Effects

Dependent Variable: SPVOL

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8.778[a]	2	4.389	6.286	.007
Intercept	1095.120	1	1095.120	1568.571	.000
FAT	8.778	2	4.389	6.286	.007
Error	16.058	23	.698		
Total	1112.960	26			
Corrected Total	24.835	25			

a. R Squared = .353 (Adjusted R Squared = .297)

Custom Hypothesis Tests

Contrast Results (K Matrix)

fat Simple Contrast[a]			Dependent Variable SPVOL
Level 1 vs. Level 3	Contrast Estimate		-1.411
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-1.411
	Std. Error		.406
	Sig.		.002
	95% Confidence Interval for Difference	Lower Bound	-2.251
		Upper Bound	-.571
Level 2 vs. Level 3	Contrast Estimate		-.989
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-.989
	Std. Error		.406
	Sig.		.023
	95% Confidence Interval for Difference	Lower Bound	-1.829
		Upper Bound	-.149

a. Reference category = 3

Test Results

Dependent Variable: SPVOL

Source	Sum of Squares	df	Mean Square	F	Sig.
Contrast	8.778	2	4.389	6.286	.007
Error	16.058	23	.698		

Estimated Marginal Means

fat

Dependent Variable: SPVOL

fat	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	5.889	.279	5.313	6.465
2	6.311	.279	5.735	6.887
3	7.300	.295	6.689	7.911

Post Hoc Tests
fat

Multiple Comparisons

Dependent Variable: SPVOL

Tukey HSD

(I) fat	(J) fat	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.422	.3939	.541	-1.409	.564
	3	-1.411*	.4060	.006	-2.428	-.394
2	1	.422	.3939	.541	-.564	1.409
	3	-.989	.4060	.058	-2.006	.028
3	1	1.411*	.4060	.006	.394	2.428
	2	.989	.4060	.058	-.028	2.006

Based on observed means.

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

Homogeneous Subsets

SPVOL

Tukey HSD[a,b,c]

fat	N	Subset 1	Subset 2
1	9	5.889	
2	9	6.311	6.311
3	8		7.300
Sig.		.554	.055

Means for groups in homogeneous subsets are displayed.
Based on Type III Sum of Squares
The error term is Mean Square(Error) = .698.

a. Uses Harmonic Mean Sample Size = 8.640.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

V. Model II ANOVA Output:

Between-Subjects Factors

		N
fat	1	9
	2	9
	3	8

Descriptive Statistics

Dependent Variable: SPVOL

fat	Mean	Std. Deviation	N
1	5.889	.8054	9
2	6.311	.7253	9
3	7.300	.9754	8
Total	6.469	.9967	26

Levene's Test of Equality of Error Variances[a]

Dependent Variable: SPVOL

F	df1	df2	Sig.
.205	2	23	.816

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+FAT

Tests of Between-Subjects Effects

Dependent Variable: SPVOL

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	1095.120	1	1095.120	249.862	.004
	Error	8.770	2.001	4.383[a]		
FAT	Hypothesis	8.778	2	4.389	6.286	.007
	Error	16.058	23	.698[b]		

a. .998 MS(FAT) + 1.600E-03 MS(Error)

b. MS(Error)

Expected Mean Squares[a,b]

Source	Variance Component		
	Var(FAT)	Var(Error)	Quadratic Term
Intercept	8.640	1.000	Intercept
FAT	8.654	1.000	
Error	.000	1.000	

a. For each source, the expected mean square equals the sum of the coefficients in the cells times the variance components, plus a quadratic term involving effects in the Quadratic Term cell.

b. Expected Mean Squares are based on the Type III Sums of Squares.

Variance Components Estimation

Factor Level Information

		N
fat	1	9
	2	9
	3	8

Dependent Variable: SPVOL

Variance Estimates

Component	Estimate
Var(FAT)	.426
Var(Error)	.698

Dependent Variable: SPVOL
Method: ANOVA (Type I Sum of Squares)