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Chapter 1

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chapter 3

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APPENDIX A: ANALYSIS OF DATA IN TABLE 11.1 USING SPSS VERSION 15.0

1. Entering the data given in Table 11.1

1.1 Create three columns: gender, llv and OPP.
1.2 Code the men as 1 and the women as 2 in the gender column (column 1).
1.3 Put the llv data into column 2.
1.4 Put the OPP data into column 3.

This codes the data according to gender.

2. Splitting the data by gender

2.1 Single click Data on the menu bar.
2.2 Single click on Split File.
2.3 Single click on Compare groups.
2.4 Double click on gender so it is contained within the Groups Based on box.
2.5 Single click on OK.

This splits the data on the basis of gender.

3. Descriptives

3.1 Single click on Analyze on the tool bar.
3.2 Single click on Descriptive Statistics.
3.3 Single click on Descriptives.
3.4 Double click on variables OPP and LLV in the variable(s) box.
3.5 Single click on options.
3.6 Single click on S.E. Mean.
3.7 Single click on Continue.
3.8 Single click on OK.

This gives descriptive data for llv and OPP in the men and women. You should have values of (mean, SEM) 7.41, 0.14 l and 1007, 23 W for the men and 5.19, 0.12 l and 673, 16 W for the women.

Remember to remove the split after you have obtained the descriptives. Do this by:

3.9 Single click Data on the menubar
3.10 Single click on Split File.
3.11 Single click on 'Analyze all cases, do not compare groups.'
3.12 Single click on OK.

4. Calculate ratio standards

4.1 Single click Transform on the menu bar.
4.2 Single click on Compute Variable.
4.3 In the Target Variable box, type a name; e.g. Oppratio.
4.4 In the Numeric Expression box type OPP/llv.
4.5 Single click on OK.

This calculates simple ratio standards OPP/llv in the men and women.

5. Recoding the gender variable

5.1 Single click on Transform on the menu bar.
5.2 Single click on Compute Variable.
5.3 In the Target Variable box, type gender.
5.4 In the Numeric Expression Box type 1.
5.5 Single click on If …
5.6 Single click on 'Include if case satisfies condition'.
5.7 Type gender=1 in the dialogue box.
5.8 Single click on continue.
5.9 Single click on OK.
5.10 Repeat steps above (5.1–5.9), but this time at step 5.4 type 0 in Numeric Expression, and at step 5.7 type gender =2 in the dialogue box.

This recoding is necessary for the regression and ANCOVA analyses

6. Using ANOVA to compare the ratio standards

6.1 Single click on Analyze in the menu bar.
6.2 Single click on Compare Means.
6.3 Single click on One-way ANOVA.
6.4 Put Oppratio into the Dependent Box and gender into the Factor Box.
6.5 Single click on Options.
6.6 Single click in the Descriptive and Homogeneity of variance check box.

6.7 Single click on Continue
6.8 Single click on OK.

This should give (mean, SEM) 136, 3 W.l^{-1} for the men and 131, 3 W.l^{-1} for the women (P = 0.206).

7. Creating gender interaction

7.1 Single click Transform on the menu bar.
7.2 Single click on Compute Variable.
7.3 Remove the If … command that created the gender variable by single clicking on 'If …' and then single clicking on 'Include all cases'. Single click on Continue.
7.4 In the Target Variable box, type gender_llv.
7.5 In the Numeric expression box, type gender*llv
7.6 Single click on OK.

This might seem to be curious but we will use this interaction to compare the gradients of the regression lines.

8. Testing interaction

8.1 Single click on Analyze in the menu bar.
8.2 Single click on Regression.
8.3 Single click on Linear
8.4 Put llv, gender and gender_llv into the Independent box.
8.5 Put opp in the Dependent box.
8.6 Single click OK.

You should see that the interaction term – gender × llv – does not make a significant contribution to the regression equation (P = 0.233) and, hence, the need for separate slopes for the male and female covariates (llv) can be rejected.

9. Regression

9.1 Single click on Analyze in the menu bar.
9.2 Single click on Regression.
9.3 Single click on Linear.
9.4 Put llv and gender into the Independent box (put gender*llv back into the variable list).
9.5 Put opp in the dependent box.
9.6 Single click on OK.

This regression analysis is, in effect, an analysis of covariance that identifies both the covariate – llv – and the gender main effect as highly significant (P < 0.001) in both cases. This result can be confirmed using the SPSS ANCOVA commands as follows:

10. ANCOVA (Linear)

10.1 Single click on Analyze in the menu bar.
10.2 Single click on General Linear Model.
10.3 Single click on Univariate…
10.4 Put opp in the Dependent Variable box.
10.5 Put gender into the Fixed Factor(s) box.
10.6 Put llv into the Covariate(s) box.
10.7 Single click on options.
10.8 Include gender in the Display Means For box.
10.9 Single click on Continue.
10.10 Single click on OK.

This completes the analysis and calculates adjusted means; i.e. values for opp adjusted for differences in llv. The values should be (mean, SEM) 748, 19 W for the women and 902, 24 W for the men (P < 0.001).

APPENDIX B

1. Log transformation

1.1 Single click on Transform in the menu bar.
1.2 Single click on Compute Variable.
1.3 In the Target Variable box, type lnllv.
1.4 In the Numeric Expression box type LN(llv).
1.5 Single click on OK.

This takes the natural logarithm of llv and creates an lnllv column.

2. Repeat for OPP

Similarly, this takes the natural logarithm of opp and creates an lnopp column.

3. Creating gender interaction

3.1 Single click Transform on the menu bar.
3.2 Single click on Compute Variable.
3.3 In the Target Variable box, type gender_lnllv.
3.4 In the Numeric Expression box, type gender*lnllv.
3.5 Single click on OK.

*As before, this creates a variable – gender*lnllv – that can be used to test for interaction.*

4. Testing interaction

4.1 Single click on Analyze in the menu bar.
4.2 Single click on Regression.
4.3 Single click on Linear.
4.4 Put lnllv, gender and gender_lnllv into the independent box.
4.5 Put lnopp in the Dependent box.
4.6 Single click on OK.

As with the raw variables, you should see that the interaction term – gender × lnllv – does not make a significant contribution to the regression equation (P = 0.515) and, hence, the need for separate slopes for the male and female covariates (lnllv) can be rejected. A common slope can be used.

5. Regression

5.1 Repeat 4 above but remove gender_lnllv from the Independent box.

Again as before, this analysis is equivalent to an analysis of covariance and there is a main effect both for the covariate lnllv and gender (P < 0.001). The analysis also identifies the allometric models that describe the relationship between OPP and lnLLV for the men and women. By taking antilogs of the constant (5.475) and the constant plus the gender indicator variable (5.475 + 0.182 = 5.657), the constant multipliers – a – for the men (286.3) and the women (238.7) are obtained. Note that b, the common gradient and hence exponent in the allometric model is also obtained (0.626). So, in the men, OPP = 286.3 × $llv^{0.626}$ and in the women, OPP = 238.7 × $llv^{0.626}$.

6. ANCOVA (Log-linear)

6.1 Single click on Analyze in the menu bar.
6.2 Single click on General Linear Model.
6.3 Single click on Univariate …
6.4 Put lnopp in the Dependent Variable box.
6.5 Put gender into the Fixed Factor(s) box.
6.6 Put lnllv into the Covariate(s) box.
6.7 Single click on Options.
6.8 Include gender in the Display Means For box.
6.9 Single click on Continue.
7.0 Single click on OK.

Simply by taking the antilogarithms of the two adjusted means (6.775 for the men and 6.593 for the women), the difference between the men's peak power output (876 W) and women's (730 W) is obtained, adjusted for differences in lean leg volume. Note that if we divide these two adjusted means by the antilogarithm of the mean lnllv for all 81 participants – 5.97 l – raised to the power 0.626 i.e. $5.97^{0.626}$ = 3.060 we obtain the mean power function ratio standards for the women, 239 $W.l^{0.626}$, and the men, 286 $W.l^{0.626}$ as derived earlier.

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