

## SPSS Lab 6 – 2 Sample T-Tests

When two samples are being compared, the samples can come from different individuals who are not matched (the samples are independent of each other) or the samples can come from the same individuals (the samples are paired with each other). The form of the t-test is slightly different for the independent samples and dependent samples types of two sample tests, and SPSS has separate procedures for performing the two types of tests.

### 1. Two paired samples T-test

Download the data file from “Data 3” from the web site. Use the file Valid.sav to test the hypothesis that the FFQ is different to the DR. The description of the data can be found on page 40 in the book under “Nutrition.” As you can see the values are always for the same person (same id) which is why this is a paired test.

- a. Write the null and alternative hypotheses for the difference between sfat\_dr and sfat\_ffq in the email you will send me.
- b. Go to Analyze | Compare Means | Paired-Samples T Test. You must select a pair of variables that represent the two conditions. Click on one of the variables in the left hand pane of the Paired-Samples t Test dialog box. Then click on the other variable in the left hand pane. Click on the arrow button to move the variables into the Paired Variables pane. In this example, select sfat\_dr and sfat\_ffq variables and then click on the arrow button to move the pair into the Paired Variables box. Click on the OK button in the Paired-Samples t Test dialog box to perform the t-test.
- c. You will see the descriptive statistics for each of the two groups (as defined by the pair of variables.) The second part of the output gives the correlation between the pair of variables, we will not bother about this value now. The third part of the output gives the inferential statistics: The column labeled "Mean" is the difference of the two means (3.016 in this example) The next column is the standard deviation of the difference between the two variables. The column labeled "t" gives the observed or calculated t value. In this example, the t value is 4.402. The column labeled "df" gives the degrees of freedom associated with the t test. The column labeled "Sig. (2-tailed)" gives the two-tailed p value associated with the test. In this example, the p value is 0.000. What do the results mean? Describe your observations in the body of the email.
- d. Describe what you would do if this were a one-tailed test – see previous SPSS lab 5.

## 2. Two independent samples T-test

The Independent Samples t-test can be used to see if two means are different from each other when the two samples that the means are based on were taken from different individuals who have not been matched. In this example, we will determine if the birthweight of baby boys is different to birthweight of baby girls. Let's use file birthweight.sav again.

- a. Write the null and alternative hypotheses in the body of the email
- b. Delete missing data
- c. Determine if this is a one-tailed or a two-tailed test. Because the hypothesis involves the phrase "different" and no ordering of the means is specified, this must be a two tailed test.
- d. Specify the  $\alpha$  level:  $\alpha = .05$
- e. Determine the appropriate statistical test. The variable of interest, birthweight, is on a ratio scale, so a z-score test or a t-test might be appropriate. Because the population standard deviation is not known, the z-test would be inappropriate. Furthermore, there are different mothers of boys and girls, and they have not been matched. Because of these factors, we will use the independent samples t-test.
- f. Calculate the t value, or let SPSS do it for you!
- g. The command for the independent samples t tests is found at Analyze \ Compare Means \ Independent-Samples T Test.
- h. Select birthweight as the test variable. Select Sex as the Grouping Variable. You need to tell SPSS how to define the two groups. Click on the Define Groups button. In the Group 1 text box, type in the value that determines the first group. In this example, the value of 1 is for boys and 2 is for girls. So you would type 1 in the Group 1 text box. In the Group 2 text box, type 2. Click on the Continue button to close the Define Groups dialog box. Click on the OK button in the Independent-Samples t Test dialog box to perform the t-test.
- i. The results have two main parts: descriptive statistics and inferential statistics. You already know about the descriptive statistics. Let's look at the inferential statistics:
  - i. The columns labeled "Levene's Test for Equality of Variances" tell us whether an assumption of the t-test has been met. The t-test assumes that the variability of each group is approximately equal. If that assumption isn't met, then a special form of the t-test should be used. Look at the column labeled "Sig." under the heading "Levene's Test for Equality of Variances". In this example, the significance (p value) of Levene's test is .261. If this value is less than or equal to your  $\alpha$  level for the test (usually .05), then you can reject the null hypothesis that the variability of the two groups is equal, implying that the variances are *unequal*. If the p value is less than or equal to the  $\alpha$  level, then you should use the bottom row of the output (the row labeled "Equal variances not assumed.") In this example, there is no p-value in the bottom row. What can you say about the variances?

- ii. The column labeled "t" gives the observed or calculate t value. In this example, assuming equal variances, the t value is 1.130. The column labeled "df" gives the degrees of freedom associated with the t test. In this example, there are 460 degrees of freedom.
- iii. The column labeled "Sig. (2-tailed)" gives the two-tailed p value associated with the test. In this example, the p value is .0259. If this had been a one-tailed test, we would need to look up the critical t in a table. Decide if we can reject  $H_0$ : The decision rule is given by: If  $p \leq \alpha$ , then reject  $H_0$ . What decision can you make and what does it mean with regards to the birthweight of boys and girls?

If we were writing this for publication in a peer-reviewed journal, we would write it as: A  $t$  test failed to reveal a statistically reliable difference between the [description of mean parameter] ( $\mu_1 = \dots, s_2 = \dots$ ) and the [description of other mean parameter] ( $\mu_2 = \dots, s_2 = \dots$ ),  $t(460) = 1.130, p = .0259, \alpha = .05$ .

## Lab Assignments

1. With the valid.sav data: Do steps 1 a. through 1 c. from above for the three other pairs of variables. Given the description of the data (from page 40 in the book), what conclusions can you draw?
2. With the birthweight.sav data: Run a 2 sample t-test that compares if there is a difference in birthweight between the younger mothers (27 or younger) and the older mothers (28 or older).