

Instructions for carrying out statistical procedures and tests using Minitab

These instructions are closely linked to the author's book:

Essential Statistics for the Pharmaceutical Sciences
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For all references to chapters or tables, see the above book.

**Using Minitab to perform a
one-sided two-sample t-test**

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Example: Table 10.1 Clearance (ml/min/kg) of an amphetamine with and without urinary acidification

The method for conducting the 1-sided test is largely the same as that for the 2-sided version, so these instructions have been abbreviated. (See [2-sided two-sample t-test](#) for full details.) The key changes required for a 1-sided test are shown emboldened.

Method 1: All the data in a single column

Label column 1 as 'Clearance' and enter the control clearances into the first 15 rows and the acidified values into rows 16-30.

Label column 2 as 'Group' and enter 'Control' in the first 15 rows and 'Acidify' in rows 16-30.

Follow the menus *Stat / Basic Statistics / 2-Sample t ...*

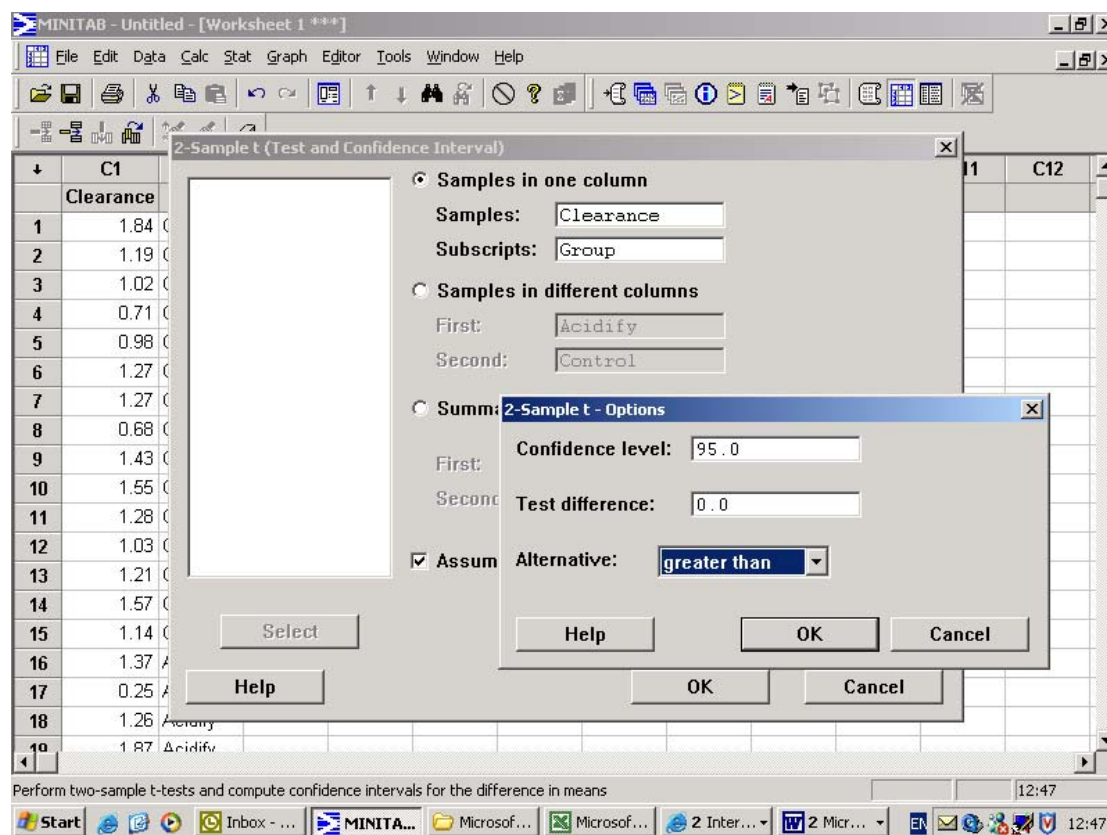
Enter 'Clearance:' in the Samples box and 'Group' in the Subscripts box.

If you want the classic t-test, you will need to select the box labelled 'Assume equal variances'.

To convert from the default 2-sided test to a 1-sided procedure, click on 'Options...'. Remember that Minitab does things alphabetically, so 'Acidify' will be treated as the First sample and 'Control' as the 'Second', so the alternative hypothesis that we want to test is therefore, that the First sample is greater than the Second. You should therefore click in the 'Alternative:' box and select 'Greater than' .

Minitab should now appear as in Fig 1 on next page:

Fig 1: Ready for a 1-sided two-sample t-test



Clicking OK should produce this output:

Two-Sample T-Test and CI: Clearance, Group

Two-sample T for Clearance

Group	N	Mean	StDev	SE Mean
Acidify	15	1.487	0.482	0.12
Control	15	1.211	0.312	0.080

Difference = mu (Acidify) - mu (Control)
 Estimate for difference: 0.275333
 95% lower bound for difference: 0.023088
 T-Test of difference = 0 (vs >): T-Value = 1.86 P-Value = 0.037 DF = 28
 Both use Pooled StDev = 0.4061

The key output begins at the line 'Difference = mu (Acidify) – mu (Control)'. So the difference is considered as the mean for the acidified individuals minus that for the control ones and the point estimate for that difference is given on the next line as 0.275333. In this case, Minitab's insistence on arranging terms in alphabetical order has led to a happy situation where the calculated difference is positive when clearance increases.

On the next line, the lower bound for the difference in clearance is given as +0.023 ml/min/kg (Ignoring excess decimal places). As the lowest credible value is positive, a zero difference is excluded, so we have significant evidence of an increase due to acidification. (See Chapter 10 for full explanation.)

The P value is presented on the penultimate line as 0.037. As this is less than 0.05, a significant result is confirmed (See Chapter 7 for full explanation of P values.)

Method 2: Data in two columns

Alternatively enter the data into two separate, suitably labelled columns (eg Control and Acidify) and then following the same menus:

Stat / Basic Statistics / 2-Sample t...

Select the button for 'Samples in different columns'. If we want an increase in clearance to register as a positive figure it is best to enter 'Acidify' as the First sample and 'Control' as the Second.

As with the first method, you will have to select the option for 'Assume equal variances' if you want a classic two-sample t-test.

To convert from the default 2-sided test to a 1-sided procedure, click on 'Options...' and then click in the 'Alternative:' box and select 'Greater than' (Because we want to test for greater values in the First sample (Acidify) than in the Second (Control)).

The output is then:

Two-Sample T-Test and CI: Acidify, Control				
Two-sample T for Acidify vs Control				
	N	Mean	StDev	SE Mean
Acidify	15	1.487	0.482	0.12
Control	15	1.211	0.312	0.080
Difference = mu (Acidify) - mu (Control)				
Estimate for difference: 0.275333				
95% lower bound for difference: 0.023088				
T-Test of difference = 0 (vs >): T-Value = 1.86 P-Value = 0.037 DF = 28				
Both use Pooled StDev = 0.4061				

Interpretation of the output is essentially as for the first method.