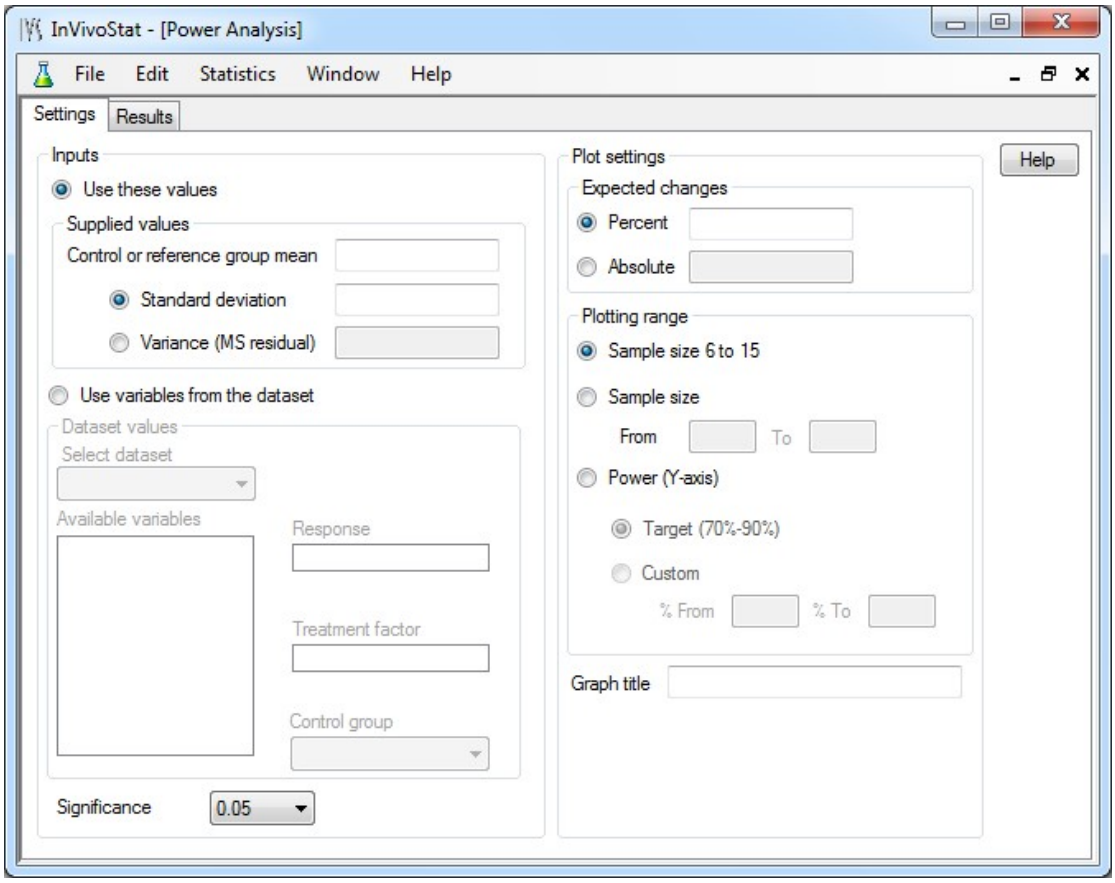
InVivoStat

Power Analysis Module

Tipsheet

The Power Analysis module in InVivoStat is available from the Statistics drop-down menu entitled 'Power Analysis'.



InVivoStat calculates samples size and power assuming the test that will be used by the scientist to analyse future data is the t-test. The t-test may not be as powerful as the test that the scientist intends to use, i.e. using an ANOVA approach, but this implies InVivoStat does not give unduly small sample sizes. We contend it is better to have sample sizes that are slightly conservative rather than failed experiments because the sample size was too small.

1 Analysis procedure

Using InVivoStat involves a series of stages:

1.1 Calculating the variability

The user needs to decide if they want to enter a control mean and an estimate of the variability, that they have calculated previously, or let InVivoStat calculate this from a dataset.

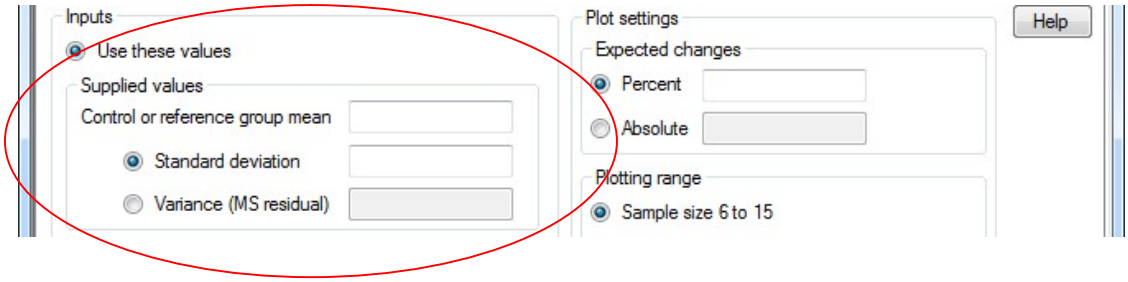
Note from the ANOVA table

$$Variance = Residual\ SS / Residual\ DF$$

where *SS* = sums of squares and *DF* = degrees of freedom

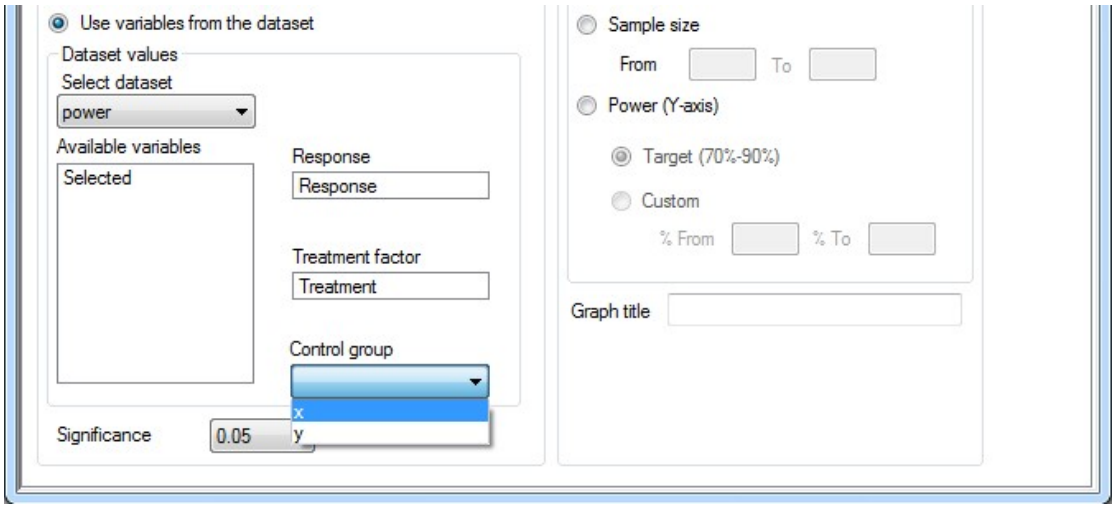
$$Standard\ deviation = \sqrt{Variance}\ .$$

The variance can be obtained from any ANOVA table; it is the Mean Square Error term. Other software, such as EXCEL, also has the functionality to calculate the standard deviation and the variance.



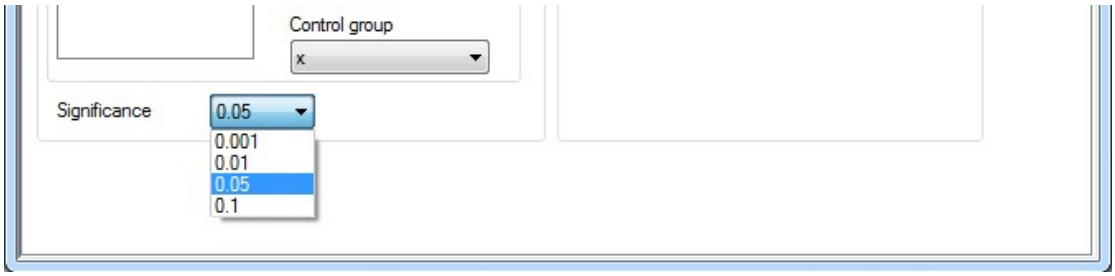
The user can also let InVivoStat calculate the variance of a parameter of interest. Once the dataset has been loaded into InVivoStat, then they should select the 'Use variables from the dataset' option. The response variable is selected by drag and dropping into the response box. They then have the option of selecting a single treatment factor. This is recommended if there is a single treatment factor in the experiment that may artificially increase the variance estimate if it is ignored.

The user can also select a control group from the levels of the treatment factor. This is required if the user wishes to investigate biological differences that are a percentage change from control.



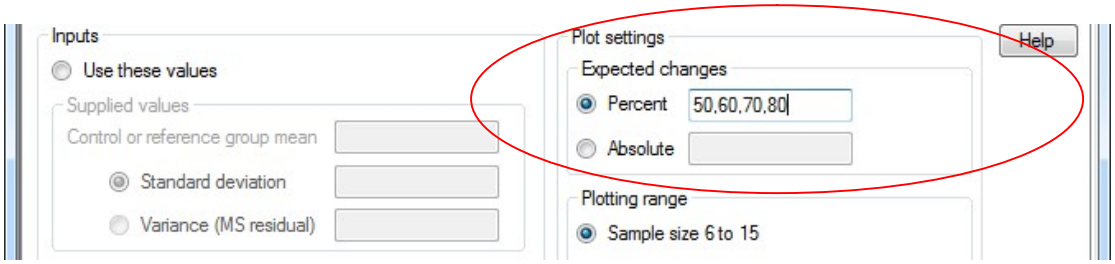
1.2 Selecting the significance level

The user can select a significance level. The default is 5%.



1.3 Plot settings – Expected changes

The user will need to decide if they want to calculate power for a 'percentage change from control' (Percent) or an 'actual change from control' (Absolute). In each case multiple differences can be selected, each difference separated by a comma, i.e.

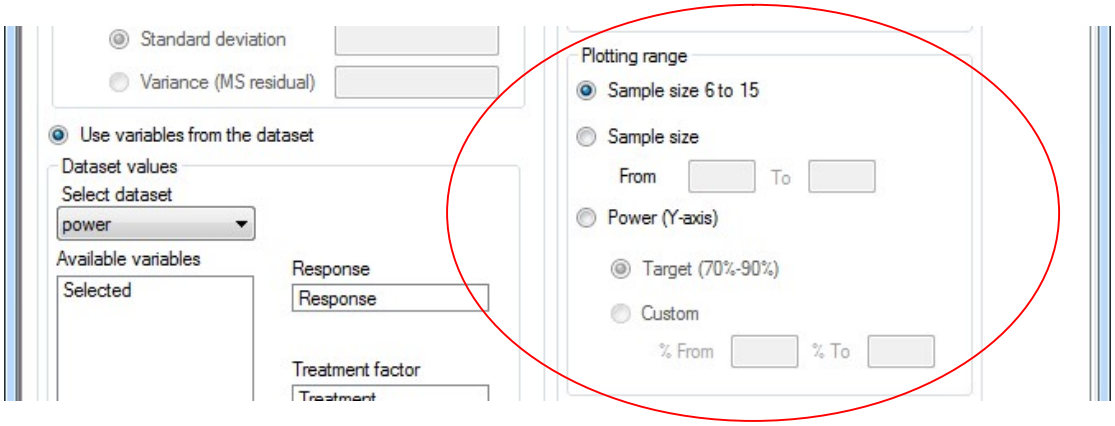


In order to select the percentage change, then the user must have specified either a control group mean (Supplied values) or a control group (Dataset values).

1.4 Plot settings – Plotting range

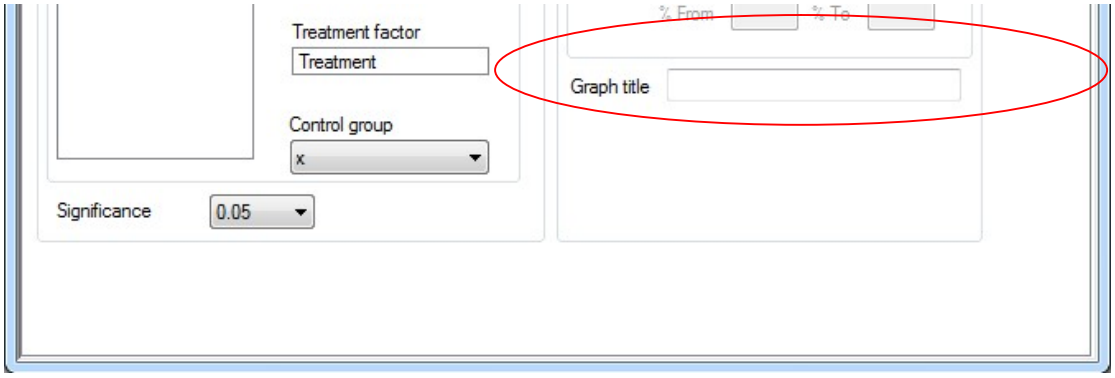
The user has various options concerning the final appearance of the power graph. The graph can be drawn for a range of sample sizes (recommended). The default is 6 to 15, although the user may select other values. Alternatively InVivoStat will calculate

the range of sample sizes (for the given difference) that achieve a desired power. This option can be useful if the user wishes to find out how many animals would be required to achieve a suitable power, given the variability of the data and a user defined biologically relevant difference.



1.5 Graph title

The user can select a title for the plot.



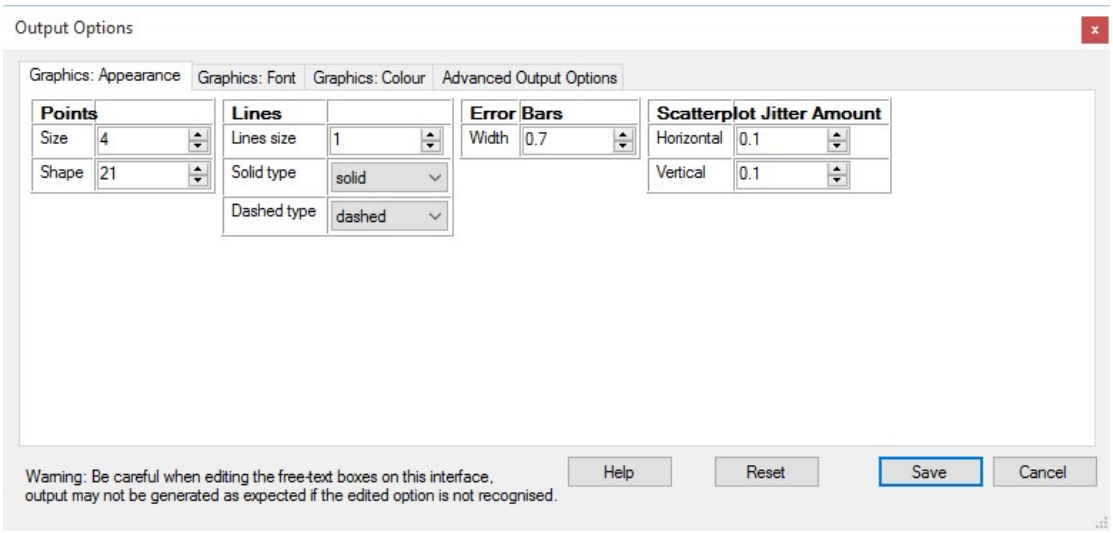
2 Controlling the output

The user has the ability to control various aspects of the output. These are available from the

Statistics → Options → Output Options

menu and should be selected before performing the analysis.

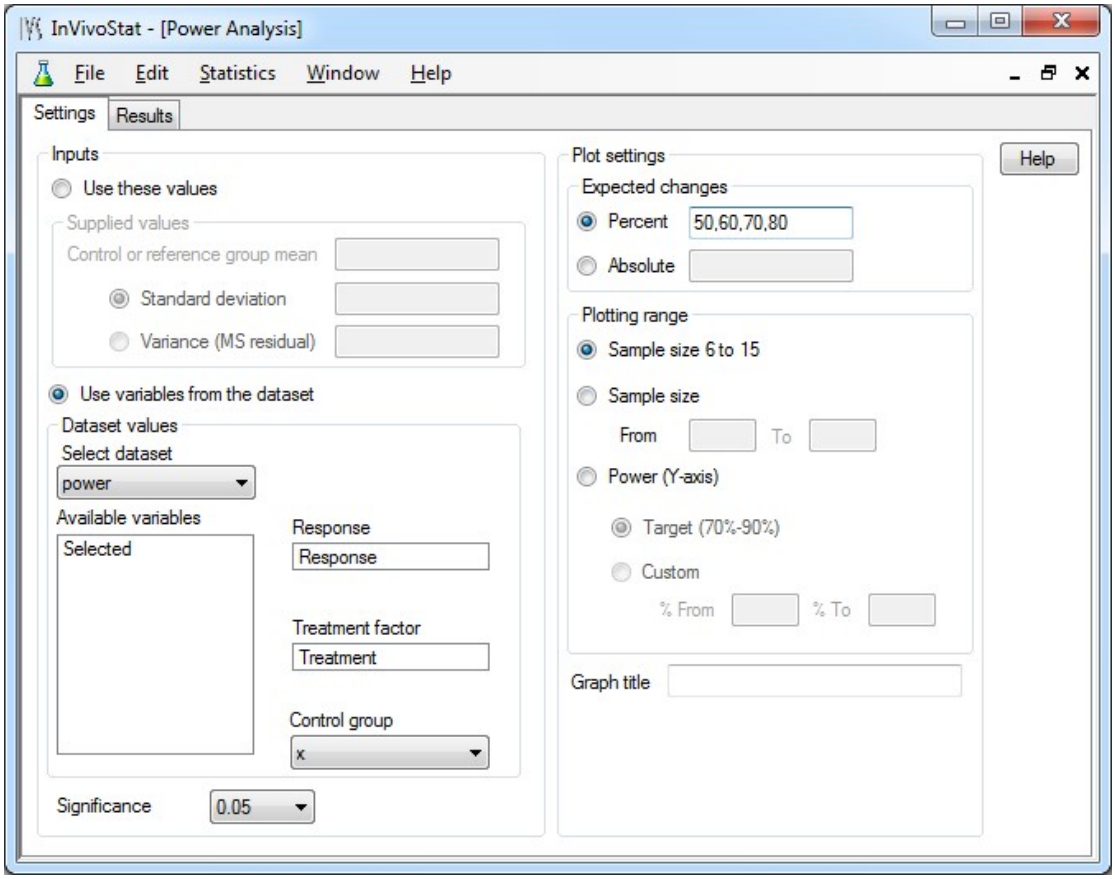
Users can manipulate various global characteristics of the plots produced. Plots can be generated in pdf format and also in black and white.



More information on the options can be found in the Getting Started tipsheet.

3 Sample output

Options:

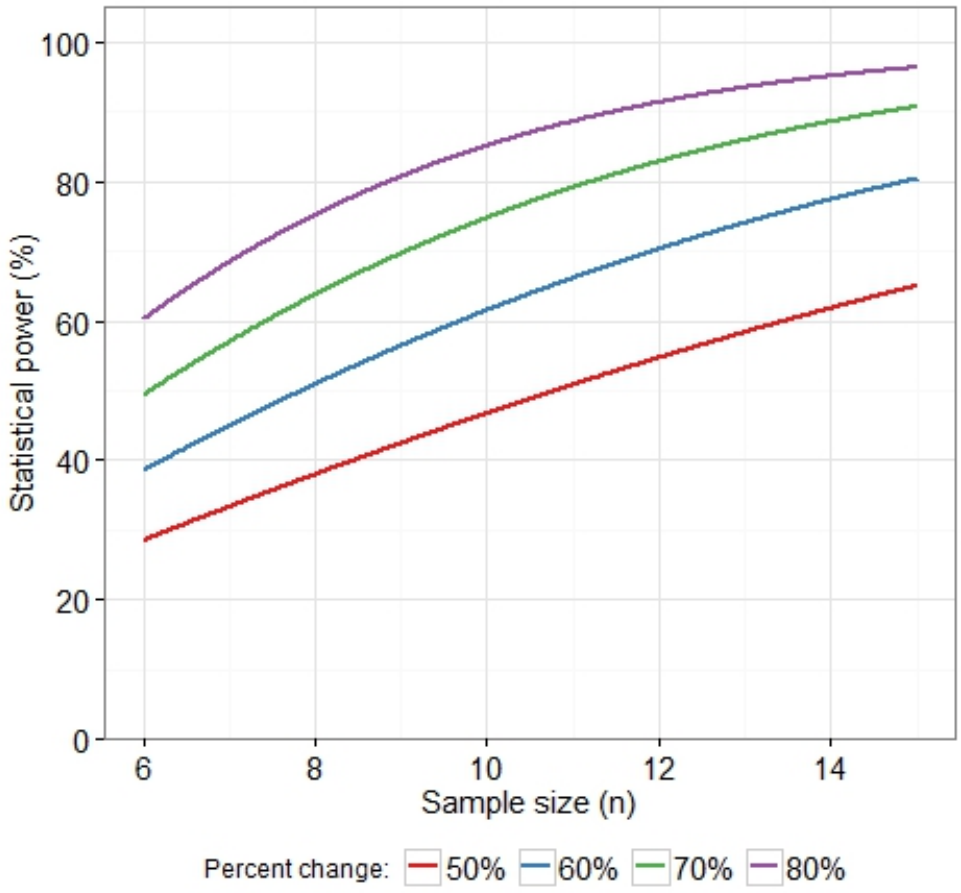


InVivoStat Power Analysis

Power calculations made by InVivoStat assume the statistical analysis will be performed using the two sample t-test. This may lead to slightly conservative estimates of sample sizes and statistical power.

For more information on the theoretical approaches that are implemented within this module, see Bate and Clark (2014).

Power curve plot



Selected results

Assuming the significance level is set at 5%, and the sample size is 6, the power of the experiment to detect a biologically relevant 50% change from control is 29%.

Assuming the significance level is set at 5%, and the sample size is 10, the power of the experiment to detect a biologically relevant 50% change from control is 47%.

Assuming the significance level is set at 5%, and the sample size is 15, the power of the experiment to detect a biologically relevant 50% change from control is 65%.

Definitions

Power: The chance of achieving a statistically significant test result from running an experiment, assuming there is a real biological effect to find.

Significance level: The chance that the experiment will give a false-positive result.

Biologically relevant effect: The size of effect that is of scientific interest.

Statistical references

Bate ST and Clark RA. (2014). The Design and Statistical Analysis of Animal Experiments. Cambridge University Press.

Harrison, DA and Brady, AR (2004). Sample size and power calculations using the noncentral t-distribution. The Stata Journal, 4(2), 142-153.

R references

R Development Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org.

Barret Schloerke, Jason Crowley, Di Cook, Heike Hofmann, Hadley Wickham, Francois Briatte, Moritz Marbach and Edwin Thoen (2014). GGally: Extension to ggplot2. R package version 0.4.5. http://CRAN.R-project.org/package=GGally

Erich Neuwirth (2011). RColorBrewer: ColorBrewer palettes. R package version 1.0-5. http://CRAN.R-project.org/package=RColorBrewer

H. Wickham. ggplot2: elegant graphics for data analysis. Springer New York, 2009.

H. Wickham. Reshaping data with the reshape package. Journal of Statistical Software, 21(12), 2007.

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. URL http://www.jstatsoft.org/v40/i01/.

Hadley Wickham (2012). scales: Scale functions for graphics. R package version 0.2.3. http://CRAN.R-project.org/package=scales

Lecoutre, Eric (2003). The R2HTML Package. R News, Vol 3. N. 3, Vienna, Austria.

Louis Kates and Thomas Petzoldt (2012). proto: Prototype object-based programming. R package version 0.3-10. http://CRAN.R-project.org/package=proto

Analysis dataset

	Response	Treatment
1	0.999	x
2	0.911	x
3	0.411	x
4	0.051	x
5	0.281	x
6	0.570	x
7	0.995	x
8	0.431	x
9	0.877	y
10	0.354	y
11	0.901	y
12	0.739	y
13	0.887	y
14	0.022	y
15	0.586	y
16	0.617	y
17	0.199	y
18	0.433	y