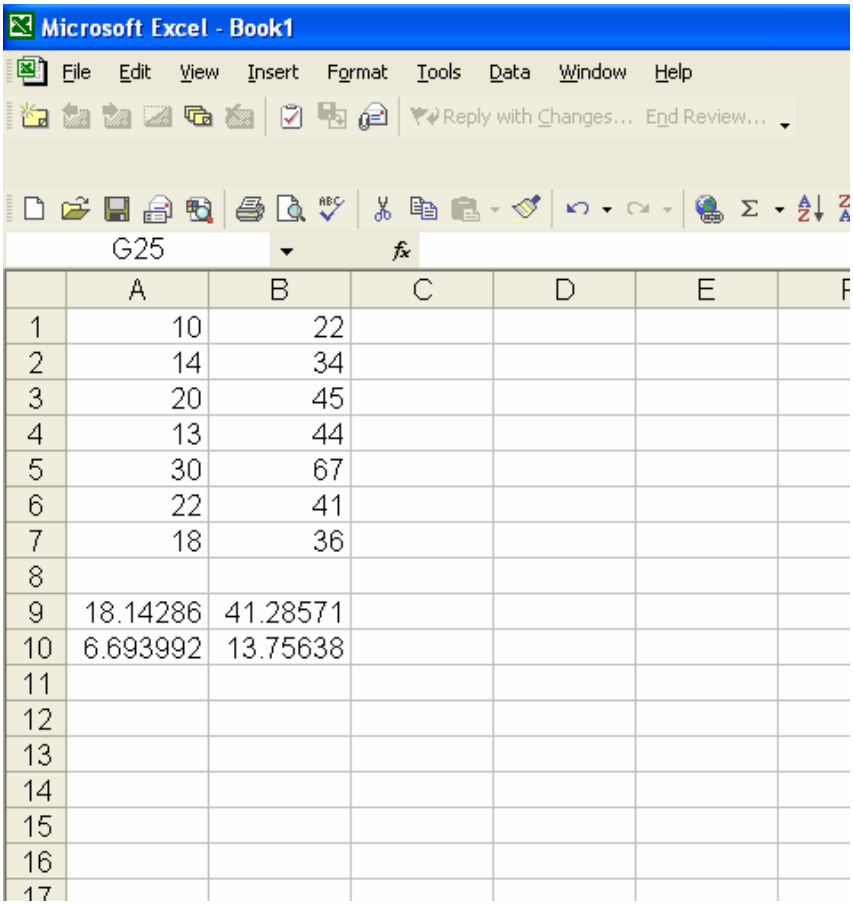
How to produce graphs using Excel:

While SPSS can produce graphs (see the relevant handout on my webpage) the ones produced by Excel are easier to obtain and look nicer. Here is a set-by-step guide to producing a variety of different types of graph, using the "Chart Wizard" in Excel - the most straightforward method for graphing. First of all though, this handout contains a little bit of background about using Excel which should be useful it you have never used it before.

The basics of Excel:

You can either start Excel by clicking on the appropriate icon, or by clicking on the name of a file created by Excel. Let's assume you have no existing file. Click on the Excel icon, and Excel starts up. It shows a new, blank ***workbook*** that's initially called "Book 1". A workbook consists of ***worksheets***, into which you can type data. By default, my computer produces a new workbook containing just one sheet, but other computers may vary. If you have more than one worksheet, you can move between them by clicking on the little tabs labelled "Sheet1", "Sheet2", etc., at the bottom of the screen.

Within a worksheet, you have ***cells*** into which you can type numbers, words, or formulas. You can move around the worksheet, from cell to cell, by using the mouse or the arrow keys. Here's my worksheet:



	A	B	C	D	E
1	10	22			
2	14	34			
3	20	45			
4	13	44			
5	30	67			
6	22	41			
7	18	36			
8					
9	18.14286	41.28571			
10	6.693992	13.75638			
11					
12					
13					
14					
15					
16					
17					

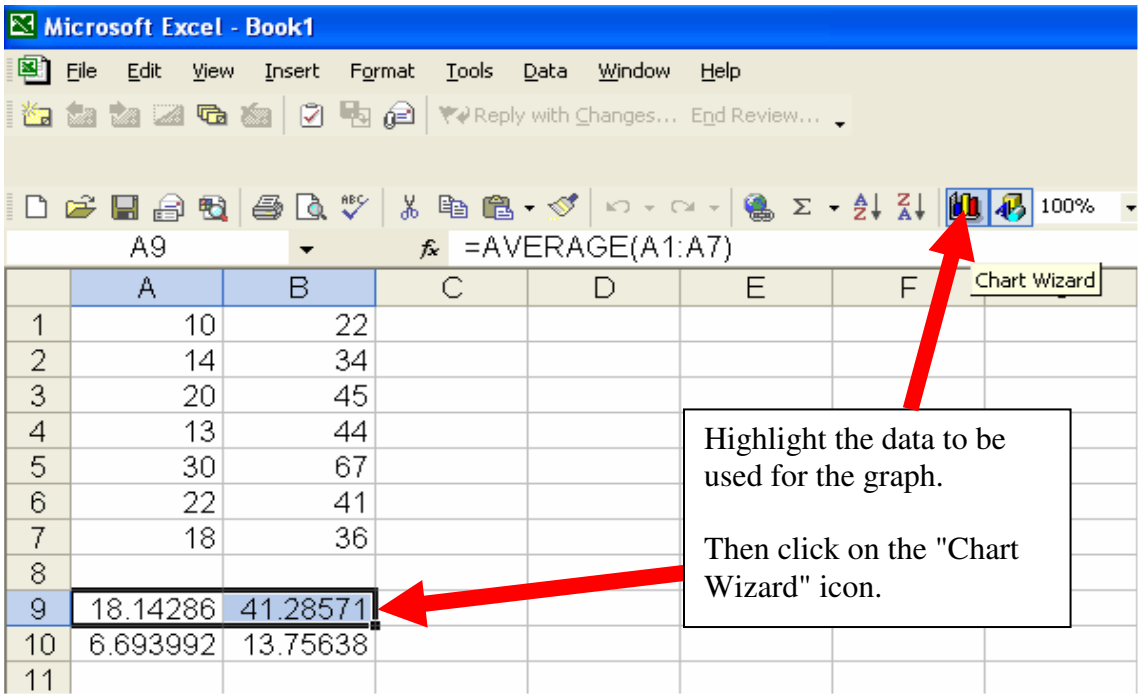
I've entered two columns of scores, and I've also asked Excel to work out the mean and standard deviation for each column. Cells are referred by their coordinates: thus, for example, the cell A1 contains the number 10; the cell B6 contains the number 41; and so on. Column A are the waistline measurements of seven people before they are force-fed pizzas for a month; column B shows these same people's waistlines at the end of the month.

The numbers in A9, A10, B9 and B10 are descriptive statistics for the columns above them. A9 is the mean of cells A1 to A7, and B9 is the mean of B1 to B7. A10 is the standard deviation of A1 to A7, and B10 is the standard deviation of B1 to B7. (The standard deviation is a measure of how scores are spread out around their mean - the bigger the S.D., the more spread out the scores). Actually, A9, A10, B9 and B10 contain formulae. If you click once on A9, the menu bar will tell you that it contains the formula for working out a mean: it will say "=AVERAGE(A1:A7)". Similarly, clicking once on B9 will produce "=AVERAGE(B1:B7)". Clicking on A10 and B10 will produce the formula for working out a standard deviation, and you will see "=STDEV(A1:A7)" and "=STDEV(B1:B7)" respectively.

Excel is much less fussy than SPSS about data organisation. In my worksheet, I've put the raw data in columns, but I could just as easily have put them in columns and had the averages and standard deviations to the right of the raw data (or anywhere else in the worksheet for that matter).

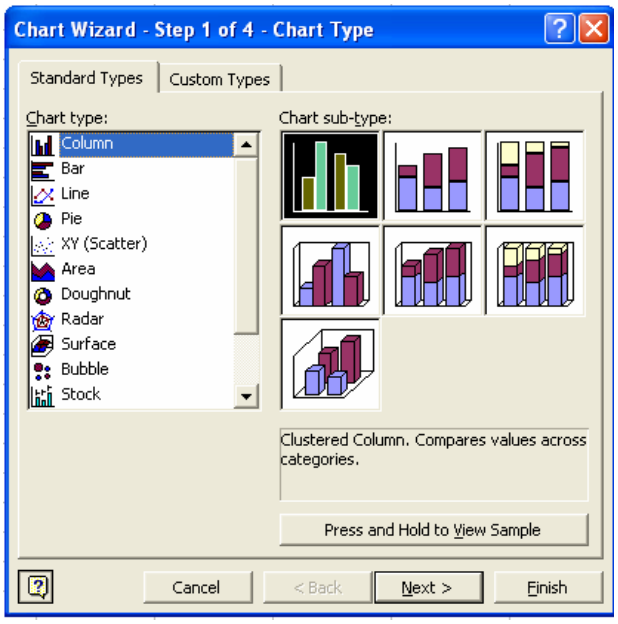
Producing a basic bar graph in Excel:

The easiest way to produce a graph is to use the "Chart Wizard", which guides you though the process set-by-step. Let's create a simple histogram, with two bars, one showing the mean contained in A9 and the other the mean in B9.

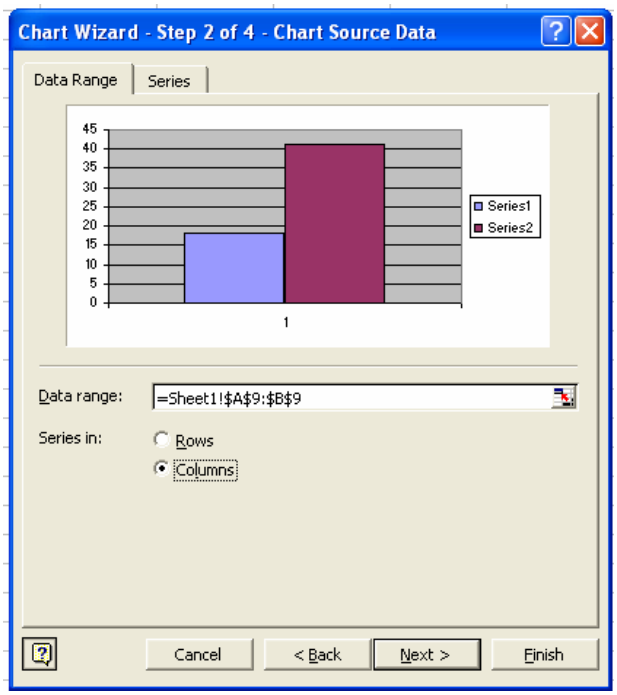


	A	B	C	D	E	F
1	10	22				
2	14	34				
3	20	45				
4	13	44				
5	30	67				
6	22	41				
7	18	36				
8						
9	18.14286	41.28571				
10	6.693992	13.75638				
11						

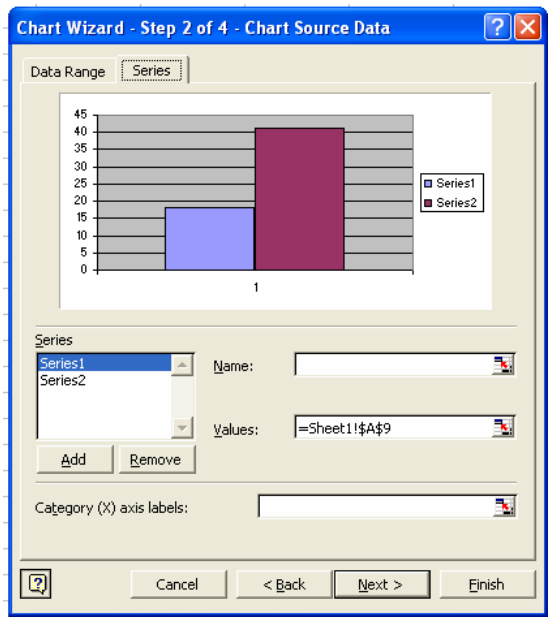
The following box pops up:



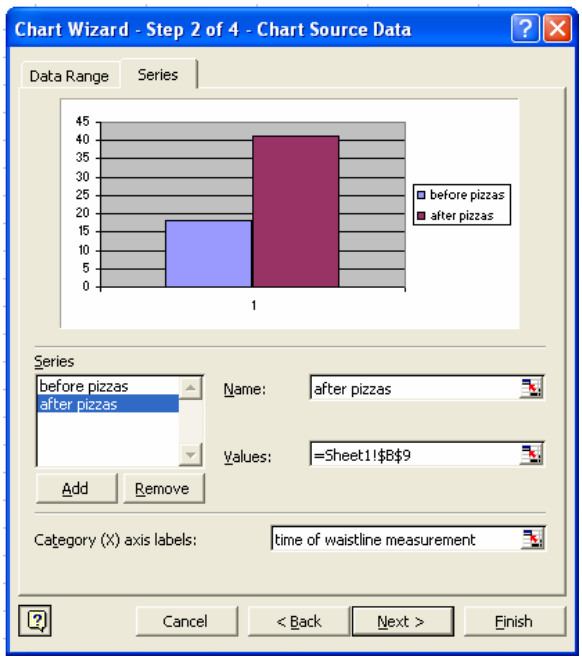
Pick which kind of graph you want, from the options on the left; and then choose a particular variant of that, from the pictures on the right. For a plain histogram, we want "column", so leave all this as it is, and simply click on "Next >" at the bottom of the box.



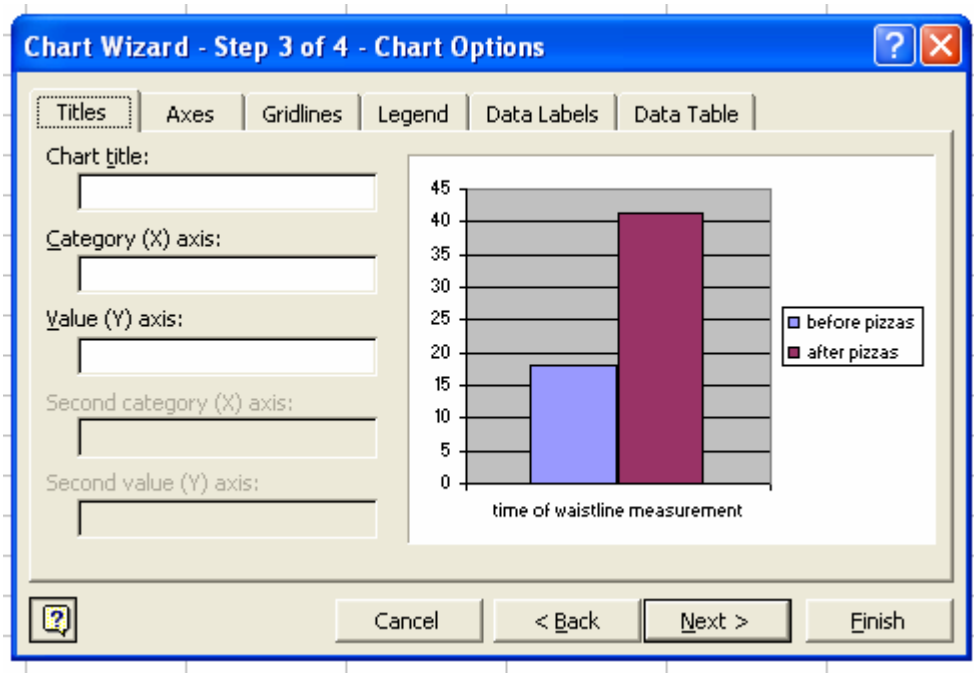
This box tells you where Excel thinks the data for the graph are located. In this case, it tells me that the data (my two average waistlines) are in A9 to B9, which is where I think they are too - so that's nice! Excel is also assuming the data are in rows rather than columns, which does not apply in this case. In effect I want a separate bar for each column, so click on "Columns". Then click on the tab at the top, labelled "Series".



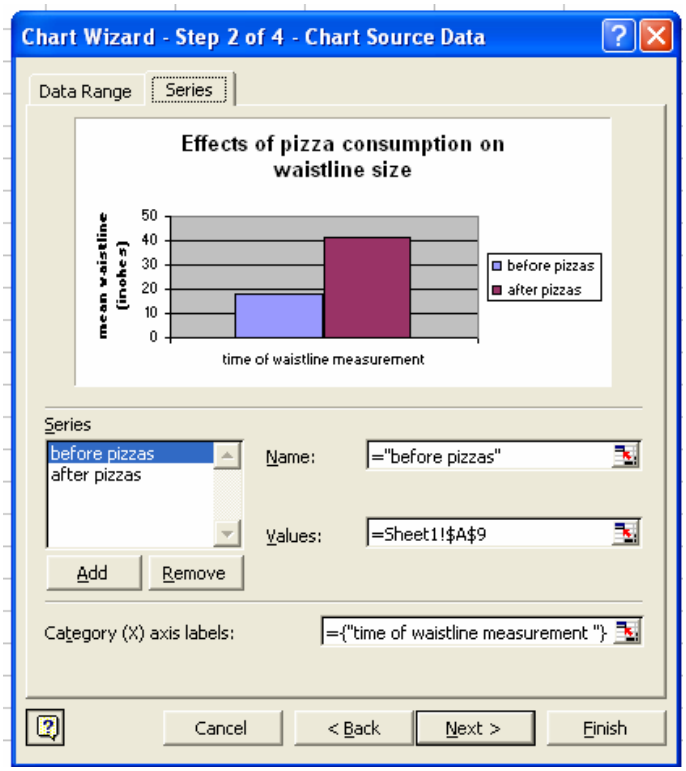
This box allows you to give each series a meaningful name, and also to add a label to the graph's horizontal (X) axis. Here's what it looks like after these changes:



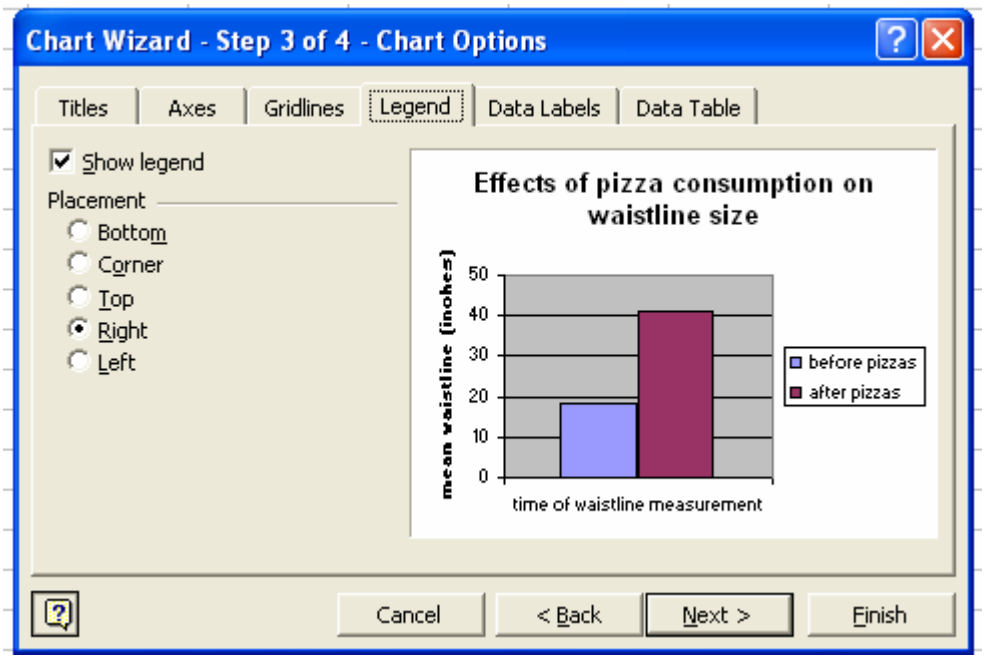
Click "Next >" when you've finished, and the next box pops up:



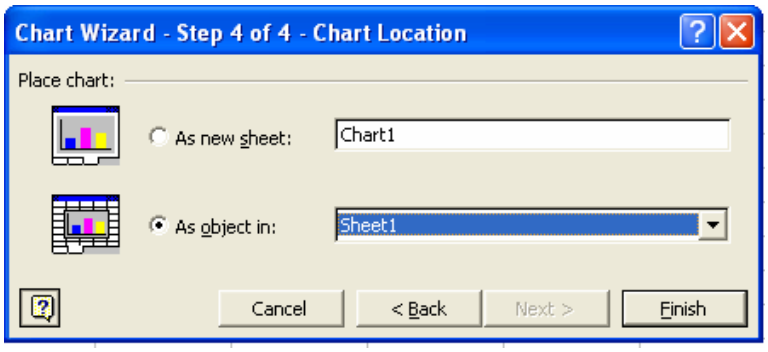
This one allows you to add a title to the graph, and labels to the horizontal (X) axis and vertical (Y) axis. The graph will change in appearance as you type these in, to give you some idea of what it will look like.



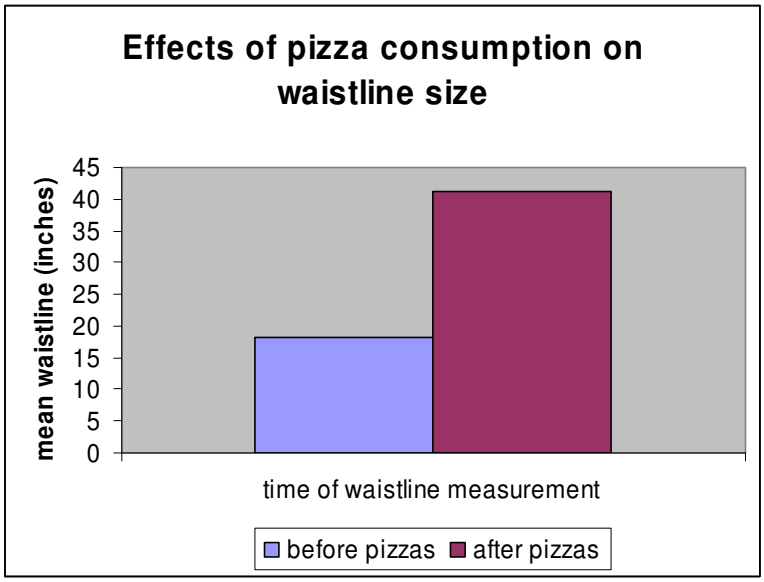
Click on "Next >" when you've finished entering labels, to get the next box. This enables you to alter the location of the legend, get rid of the horizontal grid-lines on the graph, and various other things. Click "Next >" when you are finished.



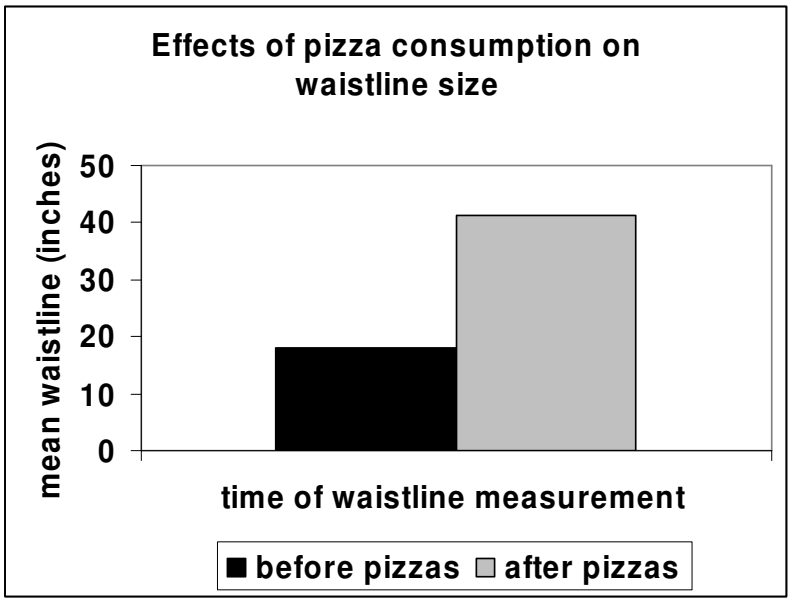
The final box gives you two options with respect to the location of the graph - as a new worksheet, or as a graph within the existing worksheet. I always leave this as it is, so that the graph appears in the existing worksheet, and just click on "Finish".



Here is my graph:



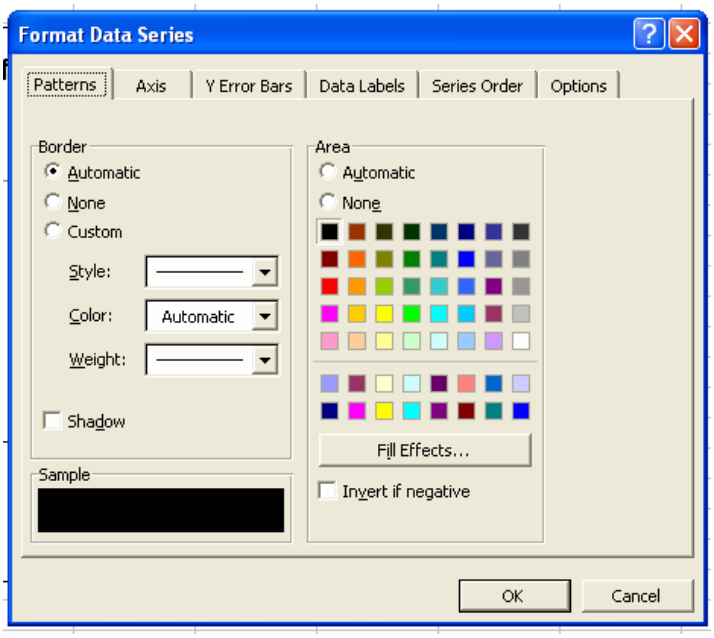
The graph remains editable within Excel. For example, if I want to get rid of the legend, I can click on it and press "delete", and it will disappear. I'm not too keen on the colours and grey background, so I'll change those. There are two ways of editing bits of the graph: you can either double-click the left-hand mouse button on something (or in some cases, such as the grid-lines, right-click), or you can click on "Chart" on the top menu and pick various options from there. Things you can do include changing the colour of the bars, altering the scale; changing the font sizes of scales, labels, titles, etc. Here's the same graph after some fiddling:



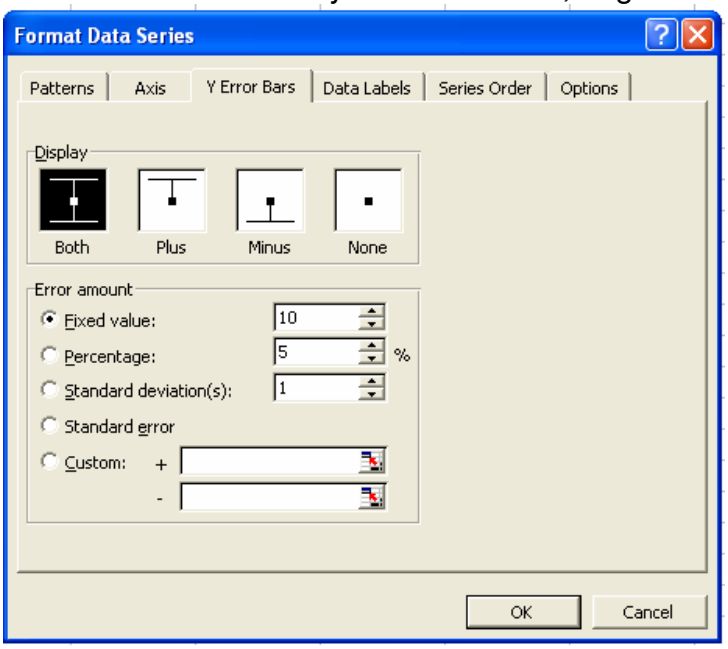
Adding error bars to the graph:

Any graph of averages should *always* have "error-bars" on it, to give some idea oh how much scores are spread out around the means that are being displayed. The most popular measures of spread are the standard deviation and the standard error (explained elsewhere). We have already worked out the standard deviations associated with our two means; now we need to put them on our graph. This is how you do it.

Double-click on the bar to which you want to add an error--bar. The following box pops up:

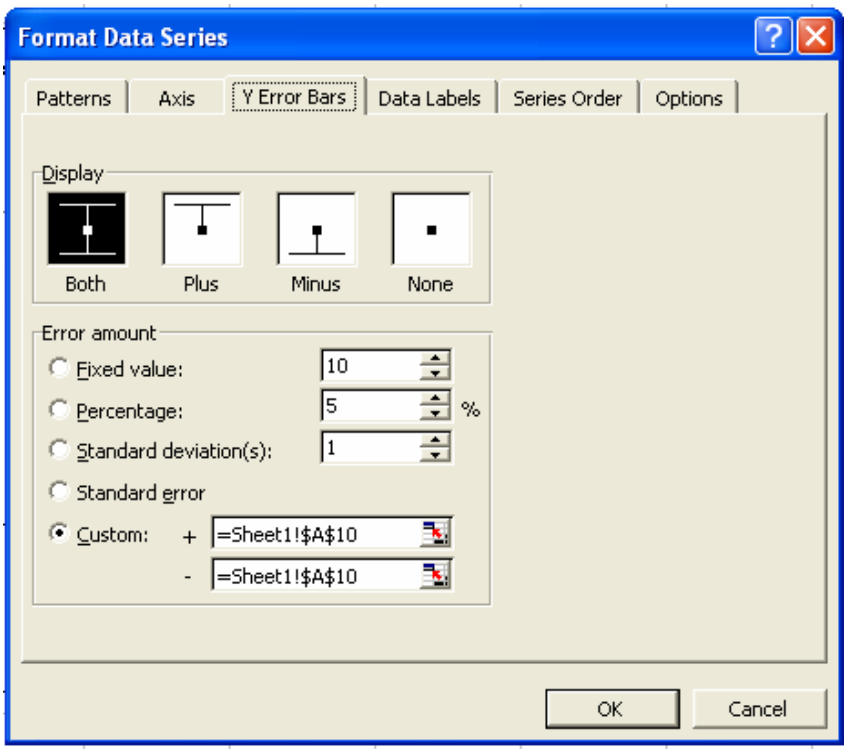


Click on the tab that says "Y error bars", to get the following box:

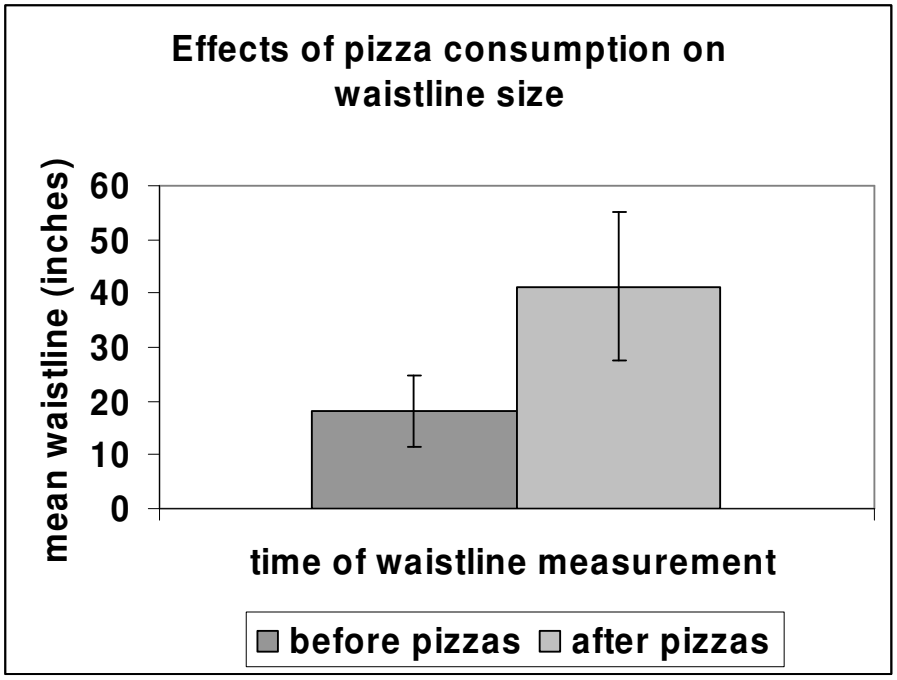


Click on "Display Both". This will allow us to put a little vertical bar on the first column of the graph, that extends from the mean plus one standard deviation to the mean minus one standard deviation. This will give us a visual impression of the extent to which scores are spread out around their means.

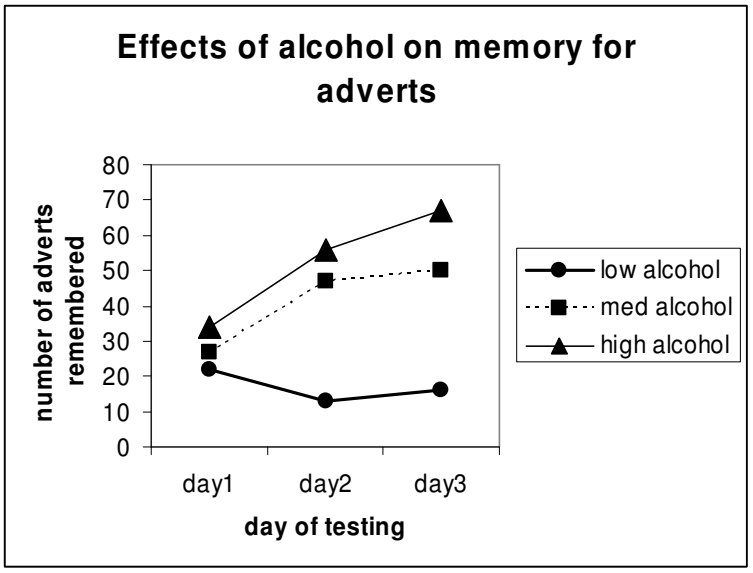
The next step is to enter the standard deviation for the first bar on our graph (which is in cell A10) into *both* of the spaces at the bottom of this box. You can do this in one of two ways - either by entering the actual *value* of the standard deviation (6.693992 in this case) or by clicking on the cell that contains this standard deviation (cell A10 in this case). The advantage of sung the second method is that if you change the data later (i.e. change the number in cell A10, *or* the data that give rise to it) then the graph will update itself in line with the new values. (Try this out for yourself). If you type the number (6.693992) the graph is fixed unless you go back to it and alter this value yourself.



(You'll notice that clicking on A10 does not appear to put the words "A10" in the box, but something longer and more scary-looking: "=Sheet1!A10". This is merely the full reference to the cell A10 on Sheet 1 of the current workbook. Don't let it bother you!). Once you have done this process or the first bar, click on "OK" to get back to the graph; then click on the second bar and repeat the process to get an error-bar on that bar too. The final graph should look like this:



Using the Chart Wizard, Excel can produce more complex graphs just as easily. Here's a line graph and the (fictitious) data that gave rise to it - see if you can get the same graph from these data.



	day1	day2	day3
low alcohol	**22**	**13**	**16**
med alcohol	**27**	**47**	**50**
high alcohol	**34**	**56**	**67**