MS Excel - Statistics

Example:

Effects of 3 preparations (A, B, C) for increasing of Mg level in blood serum of dairy cows was tested in an experiment. 4 groups of animals were included into the experiment: Control, A, B and C group. Following values of Mg (in mmol.l^{-1}) were measured:

Control	A	B	C
1.05	0.91	0.97	1.01
0.69	0.79	0.99	0.96
0.85	0.82	1.24	0.95
0.78	1.03	1.17	0.90
0.82	0.82	0.87	0.99
1.01	0.93	1.2	1.1
0.91	0.9	0.97	0.98
0.88	0.87	0.96	0.9
0.9	0.89	0.99	0.95
0.85	0.93	0.95	0.86

Calculate basic statistical parameters in each group and evaluate differences between effects of individual preparations A, B,C with respect to Control sample. Represent differences found in a graphical form.

1. Type data in the table:

	A	B	C	D	E
1	Mg Level in Blood Serum [mmol/l]				
2	Animal No.	Control	Prep. A	Prep. B	Prep. C
3	1	1.05	0.91	0.97	1.01
4	2	0.69	0.79	0.99	0.96
5	3	0.85	0.82	1.24	0.95
6	4	0.78	1.03	1.17	0.9
7	5	0.82	0.82	0.87	0.99
8	6	1.01	0.93	1.2	1.1
9	7	0.91	0.9	0.97	0.98
10	8	0.88	0.87	0.96	0.9
11	9	0.9	0.89	0.99	0.95
12	10	0.85	0.93	0.95	0.86
13	AVG	0.874	0.889	1.031	0.96
14	SD	0.10448	0.06951	0.12467	0.06733
15	SEM	0.03304	0.02198	0.03943	0.02129
16					
17					
18		F-test	0.240593336	0.606989496	0.206639762
19		t-test	0.709857769	0.006859358	0.042101424

2. B13 cell: **Insert Function(*fx*) – Statistical – AVERAGE** (In Number1: mark B3:B12 cells)
   B14 cell: **Insert Function(*fx*) – Statistical – STDEV.S** (In Number1: mark B3:B12 cells)
3. Copy marked B13 and B14cells into columns C, D, E (draw ▪ in the right low corner of the cell to the right).
4. B15 cell: Create a formula for **SEM** (Standard error of mean = SD/√n)
   Calculation formula in Excel: **=B14/SQRT(10)** (*SQRT – a function for a squareroot (of n=10) from Math. & Trig. category)*

5. Copy the formula of B15cell into columns C, D, E .

6. ***F-test comparing variances of the Control sample and PrepA. :***
   C18 cell: **Insert Function (*fx*) – Statistical – F.TEST** (into Array1: mark B3:B12 cells, Array 2: mark C3:C12 cells)
   Result (p) indicates a probability of α error in F-test calculation:
   If **p > 0.05** ⇒ **Insignificant** difference between variances (H_0: $\sigma_1^2=\sigma_2^2$ is true)
   If **p < 0.05** ⇒ **Significant** difference between variances (i.e. $\sigma_1^2\neq\sigma_2^2$)
   (similarly also for Prep.B and Prep.C: Array1 is allways Control, Array2 is appropriate Prep.)

7. ***T-test comparing means of the Control sample and PrepA. :***
   C19 cell: **Insert Function(*fx*) - Statistical – TTEST:** Array1: mark B3:B12 cells, Array2: mark C3:C12 cells,
   in **Tails**: fill no.**2** (i.e. „Two-tailed" t-test), is more exact than „One-tailed")
   in **Type**: fill no.**2** (i.e. „Two-sample **equal** variance" – *according to the preceeding F-test result, there is an insignificant difference between variances for Prep.A and Control, i.e. variances are **equal**).*
   Result (p) indicates a probability of α error in T-test calculation:
   If **p > 0.05** ⇒ **Insignificant** difference between means (H_0: $\mu_1=\mu_2$ is true)
   If **p < 0.05** ⇒ **Significant** difference between means ($\mu_1\neq\mu_2$: at the level of 5% error)
   If **p < 0.01** ⇒ **Highly significant** difference between means ($\mu_1\neq\mu_2$: at the level of 1% error)
   (similarly also for Prep.B and Prep.C: Array1 is allways Control, Array2 is appropriate Prep., in Tails is allways no.2)
   But beware of Type! *In other cases, it may be different:*
   *- In the case of a significant F-test result (i.e. different variances are proved), we fill **no.3** (i.e. „Two-sample unequal variances").*
   *- In the case of a paired experiment (comparing 2 measurements in 1 group of animals), we fill **no.1** (i.e. „Paired"; F-test is not necessary in this case.)*

8. **Chart:** mark cells B2:E2 (sample heads), then B13:E13 (AVGs) – with pushed Ctrl (for multiple block); in menu **Insert**: **Column** chart **– 2D Column.**

Change color and texture of columns (after marking separate columns): menu **Format** – **Shape Fill**. Through ⊞ in the corner of the marked chart: add **Chart Title, Axis Titles** (retype appropriate text) and **Error Bars** (in submenu choose: **More Options-Custom-Specify Value**: in the following dialog window, mark B15:E15 cells with calculated SEMs for **Positive Error Value** and the same cells (B15:E15) for **Negative Error Value**). Columns will then have different sizes of error bars displaying different variability of data in samples.