

BIOL1051C Labs

Lab 01 and Lab 02— Graphical representation of means and dispersion of the means

A picture is worth a thousand words. Anonymous

Introduction:

On the previous exercise, you calculated means ($\bar{x}$) and standard deviations (s). Means are convenient to quickly describe a numerical property of a group, say class height or volume measured by a device. However and as you saw previously, means do not say anything about the precision of the sampling or the variability of the group being sampled. To determine this one may use the standard deviation.

Another common use of the s is to use it on graphs and plots. The s allows for a quick visual comparison of variability among the means. I will now give you an example where one compares graphically three means: the heart rates of three groups of 10 students of the same sex and age measured after each group ran for a different time on a treadmill (Table I).

Table I — Heart rates (hr) of three groups of students with 10 students each. Students from each group were asked to run a predetermined time, and their hr were recorded as the mean hr measured during the last minute of exercise. Group 1 ran during 3 minutes, group 2 ran during 9 minutes, and group 3 ran during 15 minutes. Heart rates were measured in beats per minute.

group 1 (3 minute)	group 2 (9 minute)	group 3 (15 minute)
112.0	130.1	193.0
109.5	136.0	194.2
99.8	128.2	190.2
111.3	129.2	189.9
112.0	132.4	190.3
100.0	138.3	192.0
109.2	130.1	192.2
107.1	135.0	193.1
111.0	131.5	188.8
106.2	129.9	190.2

I will follow that same steps that you should. The first step is to calculate the group $\bar{x}$ and s from table you made on the previous exercise (I used the web page I linked on the previous document to calculate the values on Table II). The second step is to plot those data on a bar graph. Finally, one interprets the differences and similarities among the three means.

Table II—Statistical results for the heart rates (hr) of three groups of students with 10 students each that ran on a treadmill.

device	sample size (n)	mean ($\bar{x}$)	standard deviation (s)
group 1 (3 minute)	10	107.81	4.60
group 2 (9 minute)	10	132.07	3.32
group 3 (15 minute)	10	191.39	1.74

Discussion:

Looking at the results of the experiment, it is clear that heart rate increased with an increased duration of the running exercises (Fig. 1). Furthermore, the results within each exercise group were consistent as shown by the small standard deviations. Importantly, the small, non-overlapping standard deviations suggest that the means of the three group are significantly different from each other. To show statistically this difference, one would need to use a different, more appropriate test. However, the present method is a quick, graphical way to ascertain mean differences.

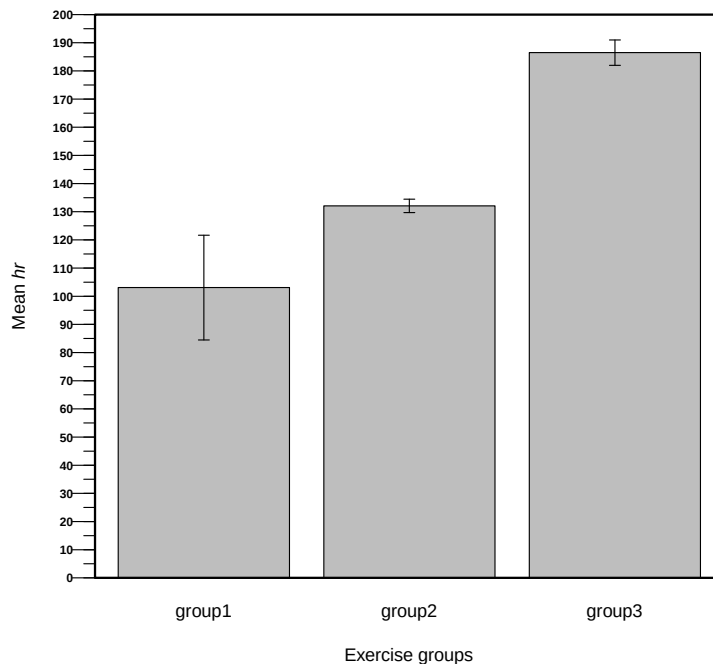


Figure 1 — Mean heart rates (hr) and standard deviations for three exercise groups running on treadmill. Group 1 ran for 3 minutes, group 2 ran for 9 minutes, and group 3 ran for 15 minutes. Groups had 10 members each all of whom were of the same sex and age. The standard deviations are shown by the wicks on the bar tops. Heart rate (hr) was measured in beats per minute.

Exercise:

Following my example above, you should graph your means from lab 01 and lab 02. In addition to a bar graph, you will need a one paragraph discussion about accuracy and precision as shown by your graph. Ideally, you should use a computer program to make the mean bars and standard deviation wicks, but a hand-drawn graph on graphing paper is also acceptable. This work should be submitted on Canvas it is worth 20 points (not extra-credit) and you have a week to do it from the date it was posted.