Cynthia Ramirez
November 8, 2023
Lab 14

Laboratory 14 – Respiratory Physiology

Purpose:

The Purpose of Laboratory 14 was to track air movement in and out of the lungs. Using devices like the FVC or Incentive inspiratory allowed us to see if our oxygen is flowing well. The spirometer helps measure pulmonary ventilation, which many hospital physicians use to prepare patients for surgery and monitor their progression afterward.

Procedure:

14-B: The Forced Vital Capacity (FVC) or Forced Expiratory Volume (FEVT) – Morgan ComPAS Pneumotrac

A Forced Vital Capacity (FVC) is an important test in that it measures the rate at which air is expelled from the lungs. Healthy lungs should be able to forcefully expel at least 80% of the vital capacity within one second and about 95% within three seconds. Failure to expel these volumes indicates an apparent air entrapment in the lungs indicative of asthma, chronic bronchitis, or emphysema.

1. The Morgan ComPAS computer program has already calculated and factored in the BTPS (Body Temperature Pressure Saturation) correction factor.

2. Fully insert the Pneumotrac filter/mouthpiece you purchased at the bookstore. If you have difficulty keeping air from leaking through your nose, you may need to wear a nose clip, as air leakage will result in inaccurate results.

3. Be sure the correct student information is loaded up before you start the FVC test.

4. After starting the FVC test, follow the verbal instructions of your instructor: begin with your mouth off the mouthpiece so the pneumotach can equilibrate; after getting a good seal with your mouth, start with tidal breathing; when you are ready, take in the deepest breath possible, then forcefully blow it out as fast as you can and keep squeezing until instructed to stop. The instructor will print out your "FVC Volume Time Curve" (part of your 14-B results), and it should look similar to Figure 14-2.

Fig. 14-

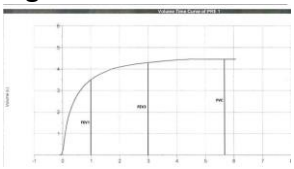

Fig. 14-2: A sample FVC from the Morgan ComPAS Pneumotrac.

5. To calculate the vital capacity for the FVC test (also called the forced expiratory volume), measure the height of the highest peak of the curve in mm and multiply that length in mm by 66.67 ml/mm (our FVC conversion factor). Then round off ml to whole numbers. (NOTE: this is similar to the 14-A SVC calculations, but with a different conversion factor.) Just like in 14-A, use the gridlines to double check that your figures are in the ballpark (e.g., if you calculated the vital capacity in Fig. 14-2 on p. 94 to be 3635 ml, you must be off because you can tell from just looking at the gridlines that it is much closer to 4500 ml than 3635 ml). Can you see this in Fig. 14-2?

6. Go to the "1 second" vertical line in your FVC graph and measure the height where the curved line crosses the 1 second vertical line in the same way as you did for the FVC in step 5. This is your FEV1 volume.

7. Divide the volume you calculated for FEV1 by the volume you calculated for the vital capacity in step 6, and then multiply by 100 to determine the percentage of the vital capacity exhaled at one second.

8. Go to the "3 second" vertical line in your FVC graph and measure the height where the curved line crosses the 3 second vertical line in the same way as you did in steps 5 and

6. This is your FEV3 volume.

9. Divide the volume you calculated for FEV3 by the volume you calculated for the vital capacity in step 6, and then multiply by 100 to determine the percentage of the vital capacity exhaled at three seconds.

10. Compare these values to the predicted values and explain possible causes for any differences.

14-D: Incentive inspiratory devices

Incentive inspiratory devices are used in clinical settings, such as hospitals, for rehabilitating respiratory and cardiac patients. When patients undergo open-heart surgery, for example, the respiratory muscles are cut and need to be strengthened following surgery to avoid complications such as pneumonia. In addition, these incentive inspiratory devices are sometimes used by patients who remain bed-ridden for long periods. Since inspiration is an active process, these muscles are targeted during rehabilitation. The patient can see the progress that is being made and have incentive to improve. Several different models of these instruments are available but all are based on the same premise of having the patient breath in as deeply as possible. You will have the opportunity to try one or more of these devices and measure your inspiratory capability.

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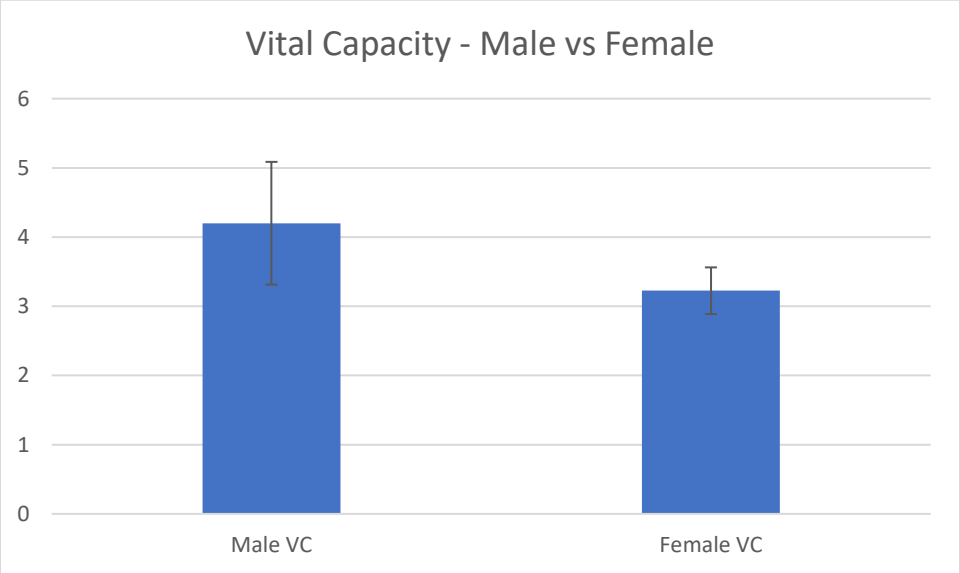
1. Obtain an incentive device and attach your disposable cardboard mouthpiece and white (or blue) filter to the breathing tube. The filter is quite a bit bigger than the breathing tube, so use your hand to try to get the best seal possible, it is not crucial to have a complete seal.

2. Breathe in as deeply as possible and record the measurement given on the device. Depending upon the model, you may have to move colored balls up plastic columns or move a bellows within a column.

3. Record your values. Discard the disposable cardboard mouthpiece and place the filter in the correct tub after use (the tub is labeled).

Results:

	Male VC	Female VC
Average	4.2	3.225
STDV	0.887	0.337



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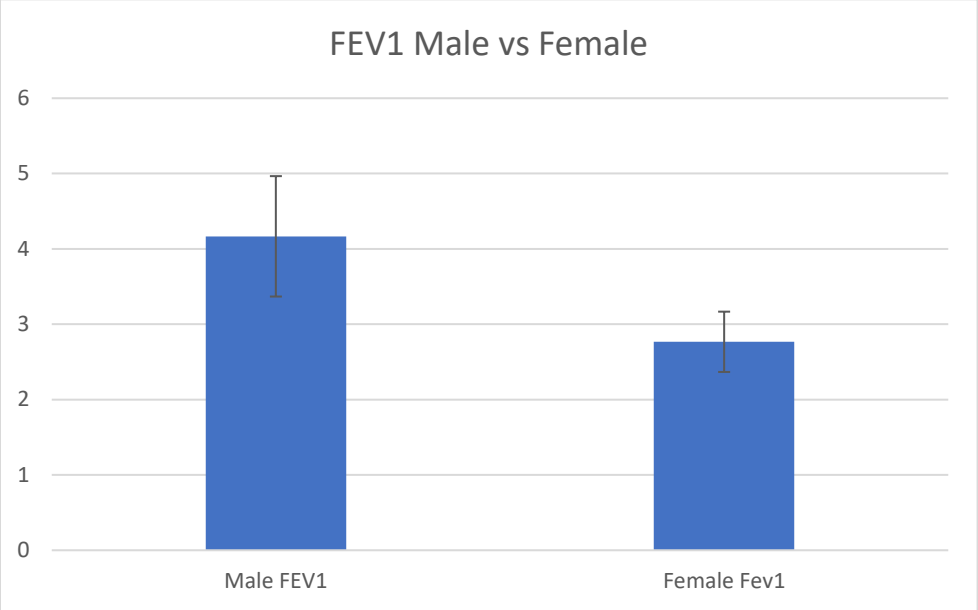
	Male FEV1	Female Fev1
Average	4.167	2.767
STDV	0.799	0.4



Discussion:

Using the Forced Vital Capacity (FVC) device was interesting. After several attempts, I understood exactly how to breathe through the machine. Hence, my breath outtake was much higher than the first attempt once I understood. Doing this test allowed my classmates and me to establish if we had healthy lungs.

For the second lab test, we, as a class, could determine our respiratory muscle strength using the Incentive Inspiratory device. Several students participated in this activity, including me, as we exhaled quickly into the mouthpiece as the computer run by Dr. Oak evaluated our readings. We then collected all the students' results to determine the male and female average on muscle respiration.

Conclusion:

Both lab experiments were fun, yet I worried about my results not being good since I am older. But fortunately, they were fine. I noticed quite a few students struggled at first with understanding how to use and read the Forced Vital Capacity device, but as teams figured it out, documenting the results. I would do both experiments again.