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Thursday Lab

11/16/2023

Lab #14 Respiratory Physiology

Purpose: To observe the lung capacities of tidal volume, vital capacity, inspiratory capacity, inspiratory reserve volume, expiratory capacity and expiratory reserve volume.

Procedures:

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

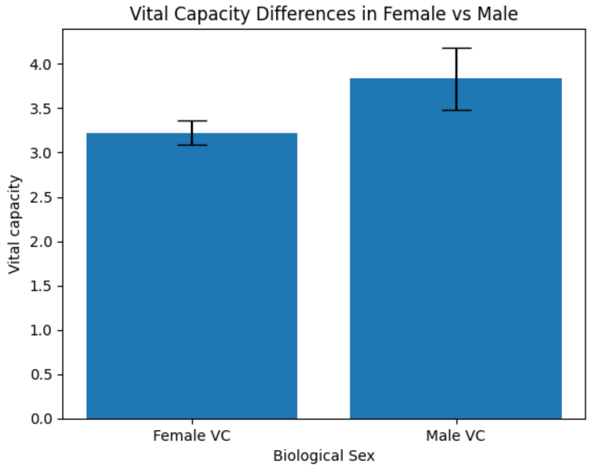
1. The Morgan ComPAS computer program has already calculated and factored in the BTPS (Body Temperature Pressure Saturation) correction factor.
2. Fully insert the Pneumotrac filter/mouthpiece you purchased at the bookstore. If you have difficulty keeping air from leaking through your nose, you may need 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.
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 66.67ml/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 onp.94to 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 instep5. This is your FEV1volume.
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.

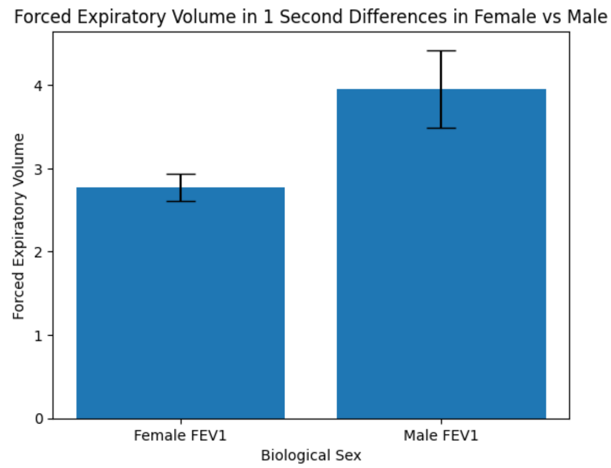
8. Go to the “3 second” vertical line in your FVC graph and measure the height where the curved line crosses the 3 second vertical line in the same way as you did in steps 5 and 6. This is your FEV3 volume.
9. Divide the volume you calculated for FEV3bythe volume you calculated for the vital capacity 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 – C: Portable Spirometry

1. Open the grey plastic box on your lab desk that says “BASELINE Lung Capacity Spirometer” on the lid. Inside the lid of the box is a white paper that has specific instructions, please read the whole inside page with “how to use.”
2. Insert the clear plastic mouthpiece on the “Windmill-Type” spirometer and make sure the measurement indicator is at the zero position before beginning.
3. Make sure you only exhale into the spirometer, DO NOT inhale from it.
4. After exhaling, record the measurement from the spirometer. Be sure to place your used plastic mouthpiece in the correct tub after use (the tub is labeled).
5. Calculate your predicted vital capacity from the nomograms available in lab. Using a straight edge, make a line matching your height and age to the vital capacity prediction. Note that the VC is in liters whereas other measurements have been taken in milliliters.
6. Compare the values obtained from the portable spirometer, the predicted values from the nomograms, and the value obtained from the Koko spirometer, if available. How can you account for any differences? (NOTE: your predicted VC from the nomogram, and a comparison to the measured VC in 14-A should be included in your discussion of 14-A).

Results:





Discussion: 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. A portable spirometer enables the health care practitioner to measure a person's vital capacity when computer technology is not available.

Conclusion: In conclusion, we discovered that the movement of air in and out of the lungs is essential to maintain the important process of cellular respiration and the oxidation of nutrient molecules. The rhythmic inflation and deflation of the lungs (ventilation) simultaneously satisfies the continuous demands of cells for supply of oxygen and subsequent elimination of carbon dioxide. The volumes of air involved in pulmonary ventilation may be measured with a device known as a spirometer. The values I got from blowing into the spirometer were both 3.34. Overall, I enjoyed this lab.