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Laboratory 14 – Respiratory Physiology

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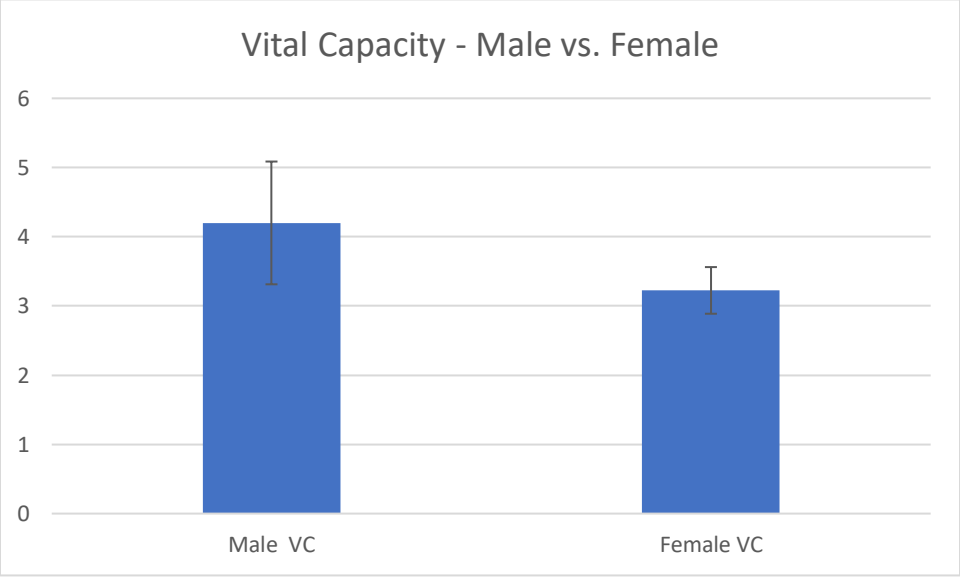
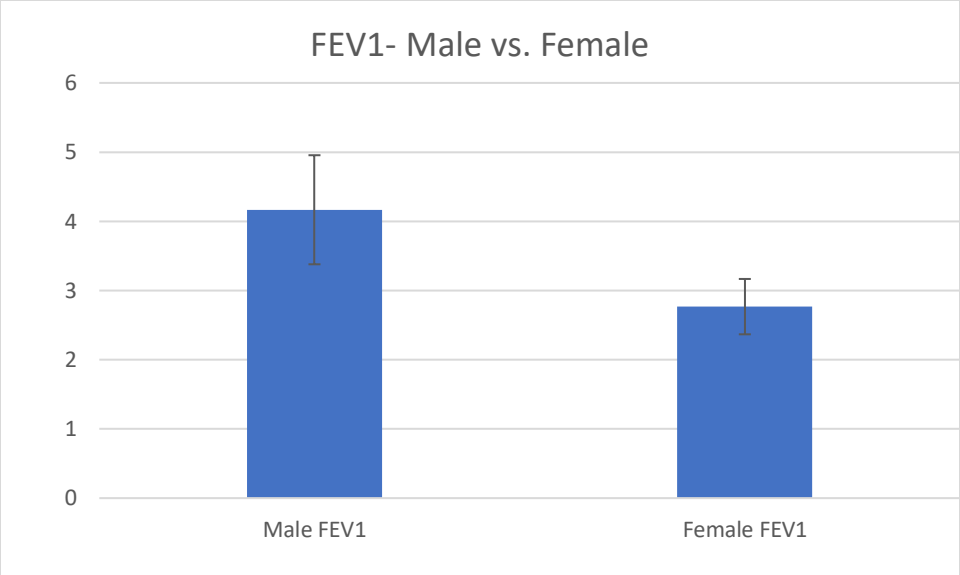
Purpose – The movement of air in and out of the lungs is essential to maintain the important process of cellular respiration, the oxidation of nutrient molecules. The rhythmic inflation and deflation of the lungs (ventilation) simultaneously satisfies the continuous demands of cells for supply of oxygen and subsequent elimination of carbon dioxide. The volumes of air involved in pulmonary ventilation may be measured with a device known as a spirometer. In this laboratory, the lung capacities of tidal volume, vital capacity, inspiratory capacity, inspiratory reserve volume, expiratory capacity and expiratory reserve volume will be recorded. The timed vital capacity (TVC) or forced expiratory volume (FEVT) will also be calculated. A spirometer coupled with a kymograph is capable of measuring and recording several human lung capacities. We will be introduced to the use and theory behind incentive inspiratory devices and a portable spirometer. impedance pneumography, the measurement of ventilation rates by recording the changing impedance of an expanding and contracting thorax, may be demonstrated.

Procedures – For laboratory 14 we were able to identify and give the function of each device used, to identify the lung volumes and capacities recorded and know average values for each, able to explain the significance of the TVC or FEVT test, explain differences in predicted and actual VC measurements, able to explain the importance of the inspiratory incentive devices, and explain the results of the impedance pneumography exercises. For 14-B, 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 lung's indicative of asthma, chronic bronchitis, or emphysema. We started of by using the Morgan ComPAS computer program has already calculated and factored in the BTPS (Body Temperature Pressure Saturation) correction factor. We inserted 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. Make sure the correct student information is loaded up before you start the FVC test. 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". 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 by66.67ml/mm (our FVC conversion factor). Then round off ml to whole numbers. 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 FEV1 volume. Divide the volume you calculated for FEV1by 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. 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 steps5and6. This is your FEV3 volume. 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. Compare these values to the predicted values and explain possible causes for any differences. For experiment 14-C, A portable spirometer enables the health care practitioner to measure a person’s vital capacity when computer technology is not available. We started of by Open the grey plastic box on your lab desk that says “BASELINE Lung Capacity Spirometer” on the lid. Insert the clear plastic mouthpiece on the “Windmill-Type” spirometer and make sure the measurement indicator is at the zero position before beginning. Make sure you only exhale into the spirometer, DO NOT inhale from it. After exhaling, record the measurement from the spirometer. Be sure to place your used plastic mouthpiece in the correct tub after use. Calculate your predicted vital capacity from the nomograms available in the lab. Using a straightedge, 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. Compare the values obtained from the portable spirometer, the predicted values from the nomograms, and the value obtained from the Koko spirometer, if available. Then we graphed our results.

Results –





Discussion – In laboratory 14, I was a little confused because I was not able to attend this lab. This experiment did sound interesting because it had to do with the respiratory system which is very important in our lives. I am trying to understand it as much as possible with the help of Dr. Oak and my lab partners. For our results we must make error graphs I think on google collab or excel. Google collab is my favorite because it is easier to make graphs, you just need to find the correct codes to put in. For this lab, our graphs we must make them on our own or at least try to make them, we need to find a code for google collab or use excel but I think google collab is way easier. Of course, Dr. Oak is there to help but he wants us to try to make them ourselves, which I understand because we can learn more and feel more confident with it. I hope I get to continue using these websites in the future. Github is a really cool app as well because we get to save all our work, we have done this whole semester, I can go back to it in the future if I ever need it. I really enjoy doing these labs because we get to work as a group and figure the graphs out together. Thanks to Dr. Oak for helping us figure all of it out.

Conclusion – All in all, Laboratory 14, we will be introduced to the use and theory behind incentive inspiratory devices and a portable spirometer. impedance pneumography, the measurement of ventilation rates by recording the changing impedance of an expanding and

contracting thorax, may be demonstrated. The movement of air in and out of the lungs is essential to maintain the important process of cellular respiration, 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. This was a very interesting lab because usually a spirometer is to measure the lung capacity when you damage or if there was any damage near your lungs.