

The Difference in Maximal Voluntary Ventilation in Trained Persons and Untrained Persons

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Introduction

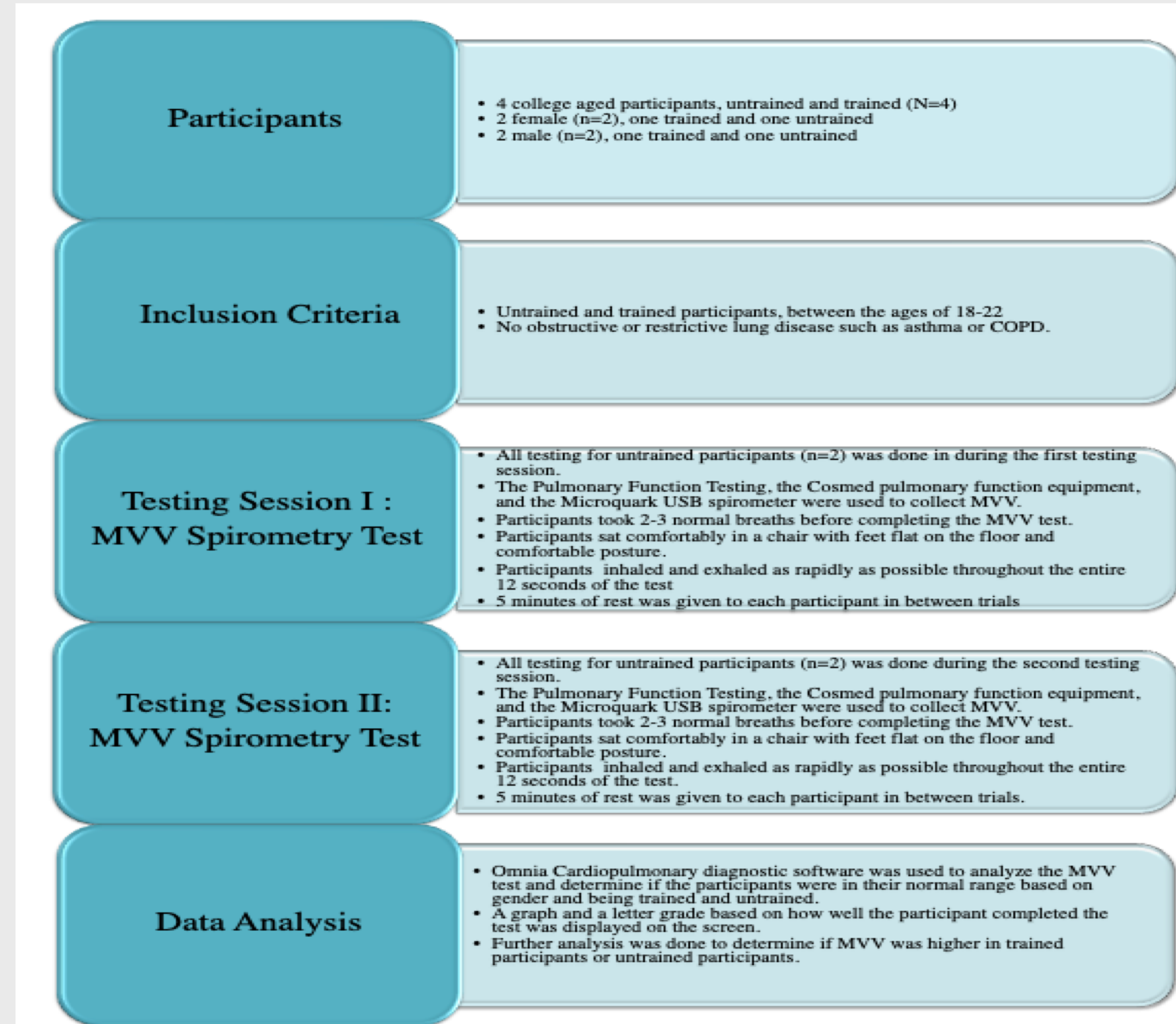
The maximal voluntary ventilation (MVV) is the maximal volume of air that a subject can inhale and exhale over a period, usually 10-15 seconds (Beam & Adams, 2014). The MVV test does not last a full minute due to extreme pH changes within the body as well as dizziness and fainting in subjects. The MVV measures the overall capacity of the respiratory system to move air, the strength of the respiratory muscles, the compliance of the lung-thorax system, and the resistance of the airways (Beam & Adams, 2014). The MVV can also be reduced in subjects with obstructive lung diseases due to a restriction in the ability to inhale or exhale (Beam & Adams, 2014).

According to Durmic et al. (2015), athletes can be distinguished from members of the general population in that, in general, the former show better cardiovascular function, larger stroke volume, and greater maximal cardiac output. Bearing all of this in mind, we can assume that athletes would present with higher spirometric values in comparison with the general population. According to Mazic et al. (2015), MVV is significantly higher in water polo players and rowers. Boxers have statistically lower MVV than the controls. Players of other sports did not differ than the control group in this particular study but this could suggest that those participating in aerobic exercise.

- **Purpose:** The purpose of this test was to determine if trained subjects have better MVV performance than untrained subjects. MVV is typically higher in young, aerobically trained athletes who have non-restrive or obstructive lung conditions and whose respiratory muscles are well trained (Beam & Adams, 2014).
- **Hypothesis:** It was hypothesized that the trained males will have higher MVV values than untrained females, trained females, and untrained males .
- **Methods:** 4 college aged students from Gardner-Webb University volunteered to participate in this lab. Two participants were untrained persons while the other two participants were trained. They were used to test maximal voluntary ventilation (MVV) using the Pulmonary Function Testing (PFT) System and the Microquark USB Spirometer. The data collected will be compared between the subjects on the basis of gender and whether they are trained or untrained individuals.



Materials & Methods



Results

Table 1: Maximal voluntary ventilation data collection for four subjects of different gender and training capacity.

Subjects	MVV (L/min) trial 1	MVV (L/min) trial 2	MVV (L/min) average
Trained Male	172	173.6	172.8
Untrained Male	153.7	166.2	159.95
Trained Female	161.4	157.3	159.35
Untrained Female	118.3	129.5	123.9

MVV= maximal voluntary ventilation, measured in liters per minute.

Table 2: Maximal voluntary ventilation data collection for male versus female subjects.

Subjects	Mean MVV (L/min)	Standard Deviation	Range
Male	166.38	9.03	173.60 - 153.70
Female	141.63	21.04	161.40 - 118.30

MVV= maximal voluntary ventilation, measured in liters per minute.

The results of this study found that MVV was highest in trained males and lowest in untrained females. Table 1 shows the first and second trial for the subjects. The average MVV for the trained male was 172.8 L/min while the average MVV for the untrained male was 159.95 L/min. Table 2 shows the mean, standard deviation and range for males versus females. The range between male MVV values had a difference of 19.9 L/min while the range between female MVV values had a difference of 43.1 L/min which can be seen in Figure 2.

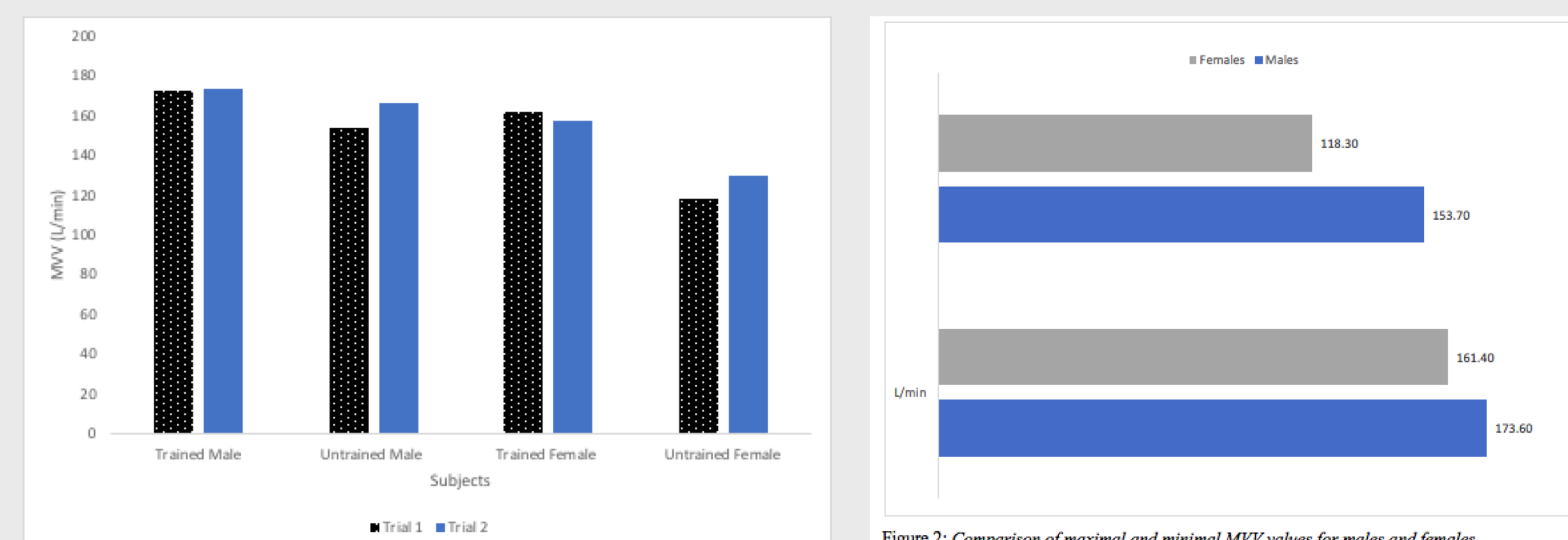


Figure 1 shows the differences between trained and untrained males and females for two trials of the MVV test. Figure 2 shows the difference between highest and lowest male and female MVV values. The trained male had the highest overall MVV values with a small variance of 1.6 L/min between the two trials.

Discussion

MVV is a spirometry test that measures an individual's ability to breathe in and out as rapidly as possible over the course of 12 seconds (Dempsey et al., 2018). A normal MVV for healthy college-age males ranges from 140-180 L/min (McArdle et al., 2015).

The MVV values for both male subjects meet the healthy range for college-age males. In the untrained male the average MVV was 159.95 L/min In the trained male the average MVV was 172.8 L/min. The range for healthy college-age women is 80-120 L/min (McArdle et al., 2015). The MVV values for both female subjects meet the healthy range for college-age females. In the untrained female the average MVV was 123.9 L/min. In the trained female the average MVV was 159.35 L/min. All subjects, except the trained female, showed improvement from Trial 1 to Trial 2. The improvement is due to familiarity with the testing procedure. Further improvements would be likely if a third trial was conducted.

As predicted in the hypothesis, the trained male presented the highest MVV value, this is likely due to the athleticism of the subject and the breathing requirements of their sports. Comparatively, the trained subjects performed better than the untrained subject of their respective sex. Untrained females performed the least well, but performance improved slightly from Trial 1 to Trial 2. This subject falls lowest within the individuals tested because their lifestyle does not require rapid breathing on a regular basis.

Physiologically, MVV dynamically measures the ability to sustain a high airflow level (McArdle et al., 2015). These lung function measures serve as excellent screening tests to detect lung disease (McArdle et al., 2015). Ventilation is the process of moving and exchanging ambient air with air in the lungs (McArdle et al., 2015). Normal regulation of ventilation retains the alveolar oxygen and carbon dioxide levels to ensure adequate airing of blood flowing into the lungs (McArdle et al., 2015)

Conclusion

In conclusion, MVV is typically higher in trained male subjects. Trained males typically have a higher MVV due to certain anthropometric measures such as height and weight as well as the amount and type of exercise done on a weekly basis. Trained individuals tend to have a higher MVV due to operating at higher proportions of their maximum ventilatory capacity (Faull, Cox, & Pattinson, 2016). Untrained and sedentary individuals tend to have a lower MVV as well as a lower ventilatory capacity due to reduced oxygen uptake when exercising and the reduced capacity for physical work (Vogiatzis et al., 2012). Additionally, gender influences lung physiology as well. According to LoMauro & Aliverti (2018), male's lungs are bigger, not only in terms of absolute volume, but also in terms of their volume variations as well. Ultimately, trained males have the highest MVV test score and MVV is a good overall indicator of ventilatory capacity (McArdle et al., 2015).

References

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