BIOPAC Systems, Inc.
Registered to ISO 9001:2015
42 Aero Camino, Goleta, CA 93117
www.biopac.com

Biopac Student Lab® Lesson 13
PULMONARY FUNCTION II
Data Report
Rev. 02202020

Richard Pflanzer, Ph.D.
Associate Professor Emeritus
Indiana University School of Medicine
Purdue University School of Science

William McMullen
Vice President, BIOPAC Systems, Inc.

PULMONARY FUNCTION II

- *Pulmonary Flow Rates*
- *Forced Expiratory Volume (FEV)*
- *Maximal Voluntary Ventilation (MVV)*

DATA REPORT

Student's Name: A. T. P. Amarasekara
Lab Section: Pulmonary Function II
Date: 12/13/2022

Subject Profile

Name: T. L. Abeygunathilaka________________________________ Height: 174 cm_____________

Age: 22 years________ Gender: Male /~~Female~~ Weight: 68.6 kg_____________

I. Data and Calculations

A. Vital Capacity (VC)

2 P-P = 4.12946 liters

B. Forced Expiratory Volumes: $FEV_{1.0}$, $FEV_{2.0}$, $FEV_{3.0}$

Table 13.2

Time Interval (sec)	Forced Expiratory Volume 2 P-P	Vital Capacity (VC) *from A*	FEV/VC *calculate*	(FEV/VC) x 100 = % *calculate*	= FEV_x	*Normal Adult Range*
0-1	3.05859	4.12946	0.74068	**74.068%**	$FEV_{1.0}$	66% - 83%
0-2	4.02979	4.12946	0.97586	**97.586%**	$FEV_{2.0}$	75% - 94%
0-3	4.12616	4.12946	0.99920	**99.920%**	$FEV_{3.0}$	78% - 97%

C. MVV Measurements

(Note, all volume measurements are in liters)

1) Number of cycles in 12-second interval: 11
2) Calculate the number of respiratory cycles per minute (RR):

RR = Cycles/min = Number of cycles in 12-second interval x *5*

Number of cycles in 12-second interval (from above): 11x 5 = 55 cycles/min

3) Measure each cycle

Complete Table 13.3 with a measurement for each individual cycle. If Subject had only 5 complete cycles/12-sec period, then only fill in the volumes for 5 cycles. If there is an incomplete cycle, do not record it. (The Table may have more cycles than you need.)

Table 13.3

Cycle Number	Volume Measurement 2 P-P	Cycle Number	Volume Measurement 2 P-P
Cycle 1	1.56107	Cycle 9	1.70175
Cycle 2	1.66469	Cycle 10	1.67289
Cycle 3	1.81464	Cycle 11	1.64757
Cycle 4	1.77296	Cycle 12	
Cycle 5	1.70317	Cycle 13	
Cycle 6	1.66674	Cycle 14	
Cycle 7	1.55907	Cycle 15	

Cycle 8	1.57614		Cycle 16	

4) Calculate the average volume per cycle (AVPC):

Add the volumes of all counted cycles from Table 13.3.

Sum = 18.34069 liters

Divide the above sum by the number of counted cycles. The answer is the average volume per cycle (AVPC)

AVPC = 18.34069/ 11 = 1.66734 liters
Sum # of counted cycles

5) Calculate the MVV_{est}

Multiply the AVPC by the number of respiratory cycles per minute (RR) as calculated earlier.

MVV = AVPC x RR = 1.66734 x 55 = 91.7037 liters/min
AVPC RR

II. Questions

D. Define **Forced Expiratory Volume** (FEV).

Forced Expiratory Volume usually expressed as FEV is the amount of air that a person can forcibly exhale in a given amount of time.

E. How do Subject's FEV values compare to the average per Table 13.2?

$FEV_{1.0}$	~~*less than*~~	*same as*	~~*greater than*~~
$FEV_{2.0}$	~~*less than*~~	~~*same as*~~	*greater than*
$FEV_{3.0}$	~~*less than*~~	~~*same as*~~	*greater than*

F. Is it possible for a Subject to have a vital capacity (single stage) within normal range but a value for $FEV_{1.0}$ below normal range? Explain your answer.

Yes, it is possible for a subject to have a normal ranged VC but a reduced forced expiratory volume in 1 second ($FEV_{1.0}$). This could occur in some medical conditions like asthma where increased airway resistance leads to decreased airflow during forceful expiration. In such cases, the subject may have difficulty expelling air out of the lungs quickly, resulting in a lower $FEV_{1.0}$ value even though the total volume of air they can exhale (VC) is within the normal range.

G. Define **Maximal Voluntary Ventilation** (MVV.)

Maximal Voluntary Ventilation (MVV) is the maximum amount of air that a person can voluntarily inhale and then exhale during a 10-15 second interval.

H. How does Subject's MVV compare to others in the class? ~~*less than*~~ *same as* ~~*greater than*~~

The values are nearly equal among the subjects.

I. Maximal voluntary ventilation decreases with age. Why?

Aging leads to a reduction in lung elasticity and compliance, which makes it harder to expand and contract the lungs efficiently. Additionally, the muscles involved with respiration, including diaphragm and intercostal muscles tend to weaken with age, which can further contribute to a decrease in MVV. Other age-related factors including reduced respiratory drive, reduced oxygen diffusion capacity and changes in lung structure and functions can also affect MVV

J. Asthmatics tend to have smaller airways narrowed by smooth muscle constriction, thickening of the walls, and mucous secretion. How would this affect vital capacity, $FEV_{1.0}$, and MVV?

Vital capacity will not be changed significantly due to the asthma conditions although it would take considerable amount of extra effort for the same amount of VC due to the increase of the airway resistance. Both $FEV_{1.0}$ and MVV will be reduced as the airway resistance is increased due to the reduction if airway diameter and other factors.

K. Bronchodilator drugs open up airways and clear mucous. How would this affect the FEV and MVV measurements?

Bronchodilator drugs will increase the FEV and MVV measurements by improving airflow through the airways by opening up constricted airways and reducing inflammation.

L. Would a smaller person tend to have less or more vital capacity than a larger person? Less ~~More~~

M. How would an asthmatic person's measurement of $FEV_{1.0}$ and MVV compare to an athlete?

Explain your answer.

An asthmatic person's measurement of $FEV_{1.0}$ and MVV may be lower than that of an athlete due to the chronic airway inflammation and constriction associated with asthma. In asthma, the airways can become inflamed, swollen, and narrowed, making it harder for air to flow in and out of the lungs.

On the other hand, an athlete may have higher $FEV_{1.0}$ and MVV measurements due to their high level of physical fitness and training. Athletes typically have larger lung volumes, stronger respiratory muscles, and greater lung capacity than the average person. This can result in higher $FEV_{1.0}$ and MVV values due to their ability to generate more forceful and efficient breathing.

End of Lesson 13 Data Report