Breath Rate Variability

Aim:

To calculate and compare the breath rate variability (BRV) from the provided mother PPG data and non-pregnant female using Photoplethysmogram (PPG) signal.

Materials Required:

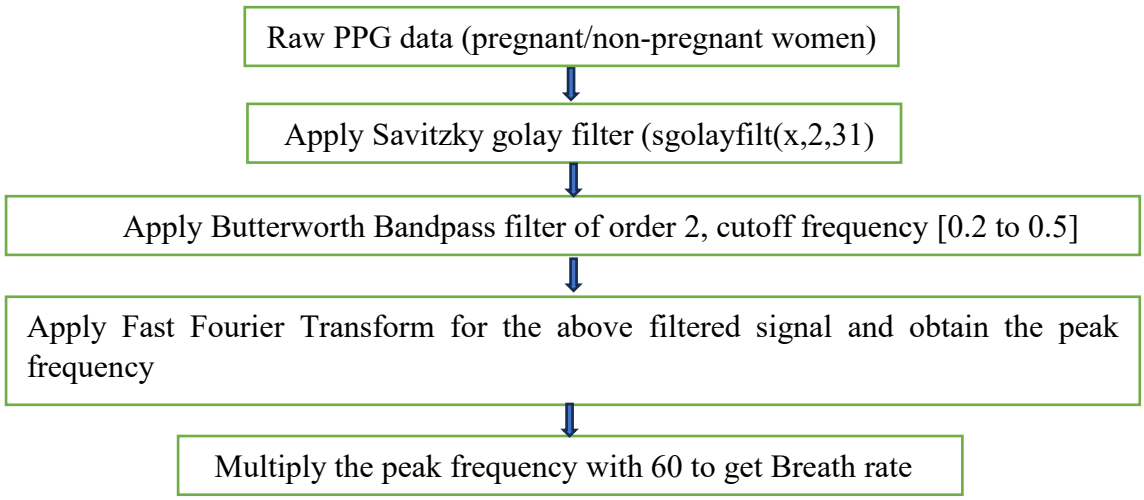
1. Computer with MATLAB.
2. PPG signal data from pregnant women
3. PPG signal data from non-pregnant women
4. Signal processing (MATLAB)

Theory of Operation:

Breath rate variability (BRV) indicates changes in breath rate over time, providing insights into respiratory function and overall health. Our lab compares BRV between pregnant and non-pregnant women using Photoplethysmogram (PPG) signals to grasp pregnancy's impact on respiratory dynamics. The normal breath rate for pregnant women varies depending on factors such as gestational age, health status, and activity level. Typically, breath rate gradually increases during pregnancy due to hormonal shifts, heightened metabolism, and adjustments in lung mechanics. During the initial trimester, the breath rate aligns with that of non-pregnant adults (12-20 breaths/min). In later stages, it may slightly elevate, reaching 16-20 breaths/min by the third trimester, possibly increasing further with activity. Individual factors and medical conditions, such as respiratory ailments or obesity, can influence breath rate during pregnancy.

PPG Signal and BRV: PPG, a non-invasive optical method, detects blood circulation changes by measuring light absorption variations. Its waveform reflects cardiac activity and respiratory modulation with rhythmic oscillations.

Post Signal Processing (using MATLAB):



Calculating Breath Rate Variability (BRV):

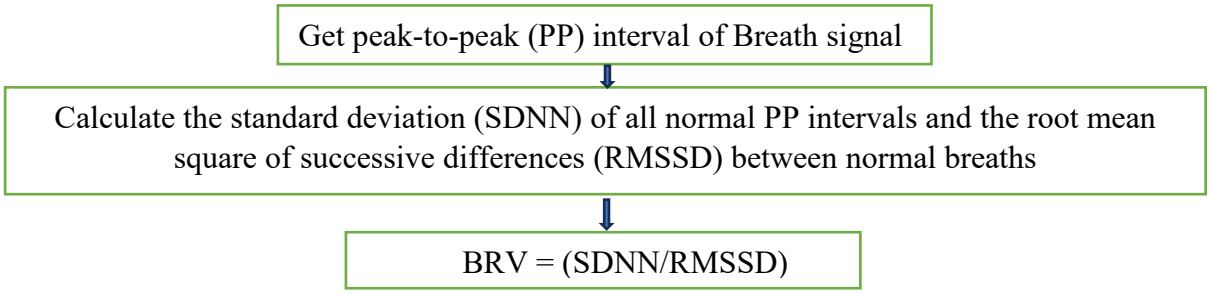


Table for Measurement:

S. No	Breath rate (breaths per min)		Breath rate variability (percentage)	
	Pregnant women	**Non-pregnant women**	**Pregnant women**	**Non-pregnant women**
1.	**23.83**	**19.83**	**17.7895**	**38.6067**

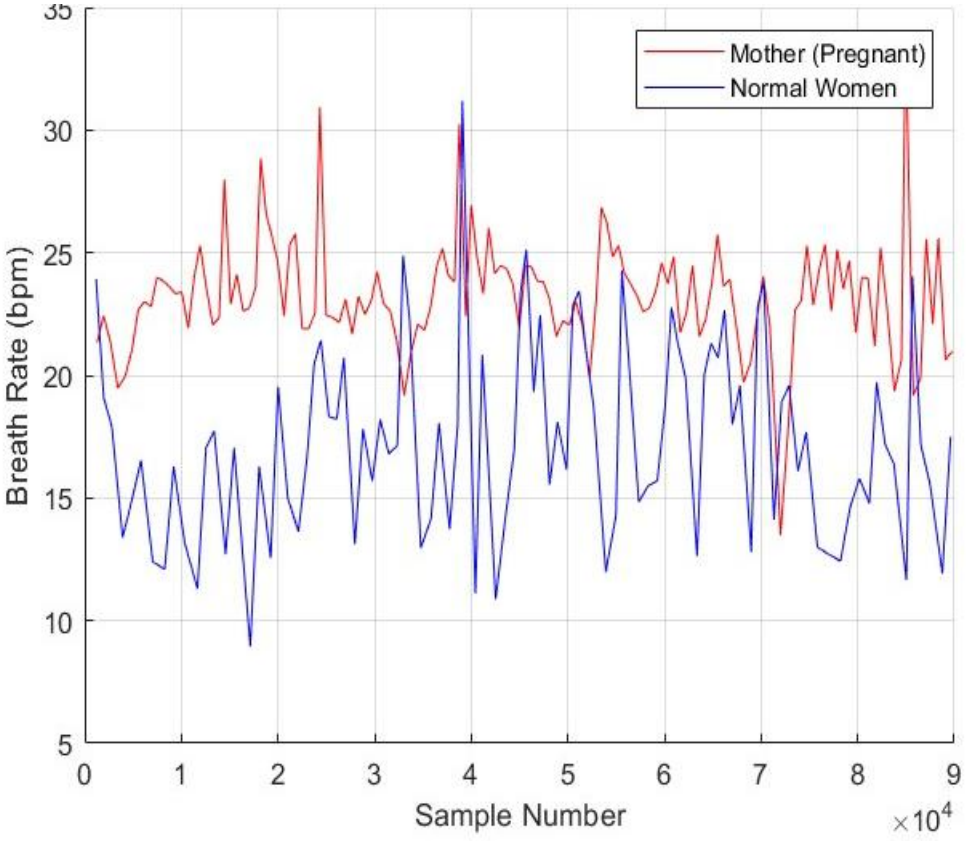
Procedure:

1) Open MATLAB.
2) Using the Signal Processing techniques mentioned above, filter the breath signal from the acquired data and extract the breath rate (BR) and breath rate variability (BRV) (Soni, 2019) of both pregnant and non-pregnant women.
3) Compare the breath rate and breath rate variability in breaths per minute for both pregnant and non-pregnant women.
4) Tabulate the extracted BR and BRV (%).

Results / Observations:

- Breath signal curve of both pregnant and non-pregnant women:
- Breath rate (Pregnant women): **23.83** breaths per minute
  Breath rate (non-pregnant women): **19.83** breaths per minute

- Breath rate variability (Pregnant women): **17.7895** %
  Breath rate variability (non-pregnant women): **38.6067** %



Reference:

1) Soni, R. and Muniyandi, M., 2019. Breath rate variability: a novel measure to study the meditation effects. *International journal of yoga*, *12*(1), p.45.