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Observational Study On The Impact Of Pregnancy On Functional Status, Hemodynamic Variables, VO2 Max, And Spo2 In Women.

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Abstract:

Aim: This observational study aimed to investigate the impact of pregnancy on various physiological parameters including functional status, hemodynamic variables, VO2 max, and SpO2 in pregnant women.

Methodology:A sample of 100 pregnant women in their second trimester was recruited for this study. Functional status was assessed using scale, while hemodynamic variables were measured through pulse oximeter and formula. Additionally, VO2 max and SpO2 were evaluated using. Data were analyzed using to determine any significant differences compared to non-pregnant controls.

Results:Systolic BP and Diastolic BP show significant positive correlation ($p < 0.05$). Pulse rate correlates significantly positively with both Systolic and Diastolic BP ($p < 0.0001$). SPO2 and VO2 MAX do not show significant correlations with other parameters except for a negative correlation between SPO2 and VO2 MAX ($p < 0.05$).

Conclusions. This study highlights the importance of understanding the physiological changes during pregnancy and their potential implications for maternal health.

Keywords-Pregnant lady, Haemodynamic changes, VO2 Max, cardiovascular system, metabolic functions

Introduction:

Pregnancy induces significant physiological changes in women, impacting various systems including cardiovascular, respiratory, and metabolic functions. While these changes are well-documented, their precise impact on functional status, hemodynamic variables, VO2 max, and SpO2 remains understudied. Understanding these changes is crucial for optimizing maternal health outcomes.[1] This study aimed to fill this gap by conducting an observational investigation into the aforementioned parameters among pregnant women.[2]Exercise testing is a useful method for cardiorespiratory functional assessment. Preoperatively, it assists in risk-stratifying patients into operative and non-operative management groups and can improve surgical outcomes.[3] As functional walking tests are straightforward and require little equipment, they are commonly employed as a morbidity assessment tool in patients with cardiac failure, respiratory disease, or other chronic conditions.[4] As such, the reference values for older patients with various chronic diseases are well characterized however, the establishment of baseline data in young, healthy women has been relatively

overlooked, even with demonstrable need and reassuring data regarding the safety of exercise during pregnancy.

Furthermore, regular exercise throughout pregnancy is known to improve perinatal outcomes for mother and child. A meta-analysis regarding the effects of maternal exercise on perinatal and childhood growth found that in normal-weight mothers undergoing exercise intervention, the rate of preterm birth (PTB) decreased by 15%, and the rates of small-for-gestational-age (SGA) and large-for-gestational-age (LGA) babies both decreased by 17%.[5] In mothers who were overweight or obese, even more significant impacts were seen, with rates of PTB reduced by 33%, SGA by 27% and LGA by 55%. Direct reductions could be extrapolated from this in rates of neonatal morbidity and mortality from prematurity, severe perineal trauma from the birth of LGA babies, elective Caesarean delivery for SGA babies, neonatal intensive care costs and bed occupancy and maternal psychological birth trauma from complicated birth.[6] This same meta-analysis also demonstrated a reduction in risk of childhood obesity for the children of normal-weight exercising mothers, which improves longer-term health for the next generation.

Methodology

Study Design: This observational study recruited pregnant women in their second trimester. Participants: 100 pregnant women aged years were included in the study.Assessmentof Functional Status: Functional status was assessed using scale or method.Measurement ofHemodynamic Variables:Hemodynamic variables including spo2 were measured using specific instruments or methods.Evaluation of VO2 Max: VO2 max was evaluated using specific protocols or devices.Measurement of SpO2: SpO2 levels were measured using pulse Oximeter.Statistical Analysis: Data were analyzed using SPSS software to compare pregnant women to non-pregnant controls.

Outcome Measurement:

1. Functional Status Assessment:

- Utilize validated questionnaires such as the Pregnancy Physical Activity Questionnaire (PPAQ) or the Pregnancy Functional Activity Questionnaire (PFAQ) to assess functional status. These questionnaires cover a range of activities of daily living, exercise capacity, and overall well-being.
- Administer the questionnaire at regular intervals throughout the pregnancy (e.g., trimester-specific assessments) to capture changes in functional status over time.

2. Hemodynamic Variables Measurement

- Measure blood pressure, heart rate, cardiac output, and systemic vascular resistance using non-invasive methods such as oscillometric blood pressure monitors, pulse oximeters, and impedance cardiography.
- Conduct measurements at baseline (pre-pregnancy) and at regular intervals during pregnancy (e.g., monthly or trimester-specific assessments) to monitor changes in hemodynamic variables.

3. VO2 Max Determination:

- Perform a graded exercise test on a treadmill or stationary bicycle to determine VO2 max.
- Follow standardized protocols such as the Bruce or Balke treadmill protocols or the Astrand-Rhyming cycle ergometer test.
- Measure VO2 max at baseline (pre-pregnancy) and at multiple time points during pregnancy (e.g., first trimester, second trimester, and third trimester) to track changes in aerobic capacity over the course of gestation.

Results:

Interpretation:

- Systolic BP and Diastolic BP show significant positive correlation ($p < 0.05$).
- Pulse rate correlates significantly positively with both Systolic and Diastolic BP ($p < 0.0001$).
- SPO2 and VO2 MAX do not show significant correlations with other parameters except for a negative correlation between SPO2 and VO2 MAX ($p < 0.05$).
- Age does not significantly correlate with any of the parameters.
- Non-parametric tests were used for skewed variables (Diastolic BP, Pulse rate, and VO2 MAX).
- Overall, there are significant correlations among blood pressure measures and pulse rate, while oxygen saturation and VO2 MAX show limited associations with other parameters in this sample.

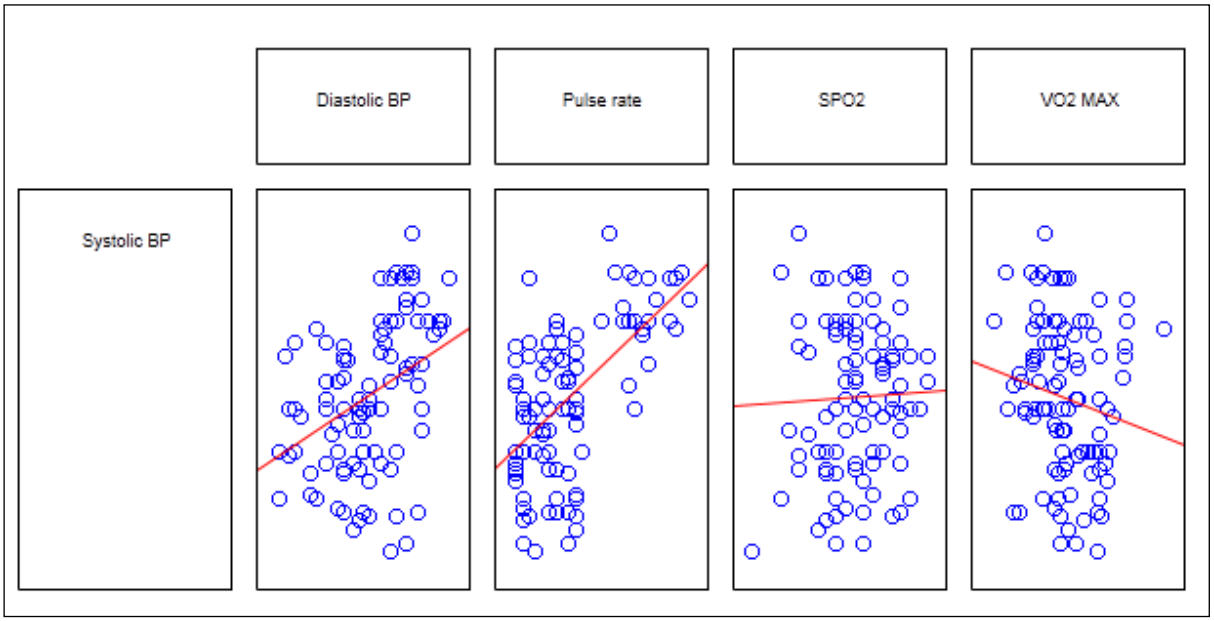
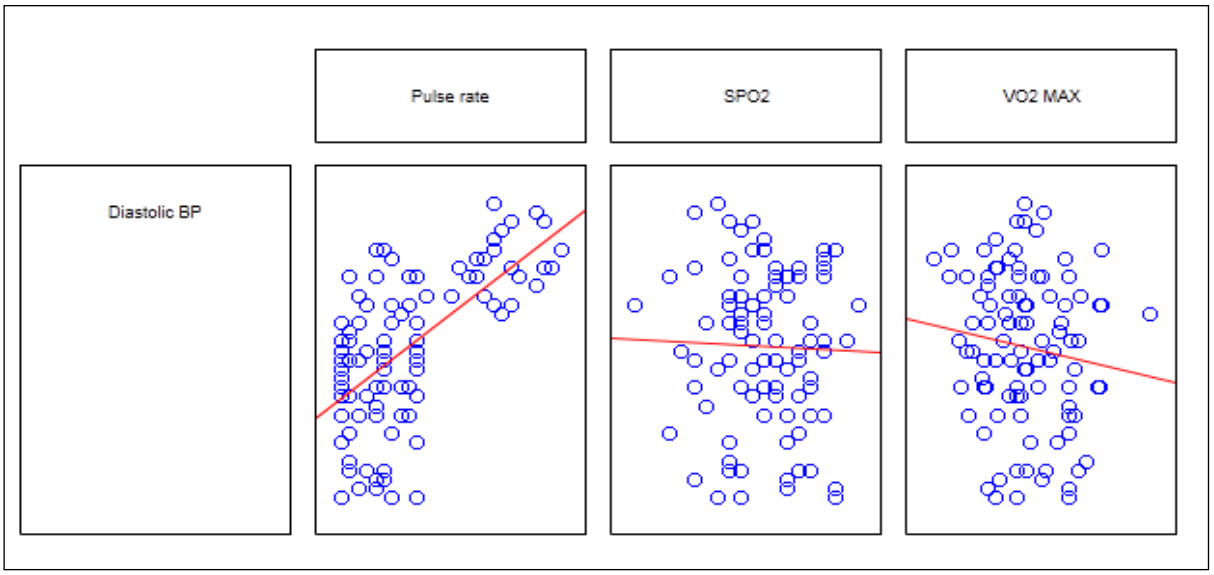
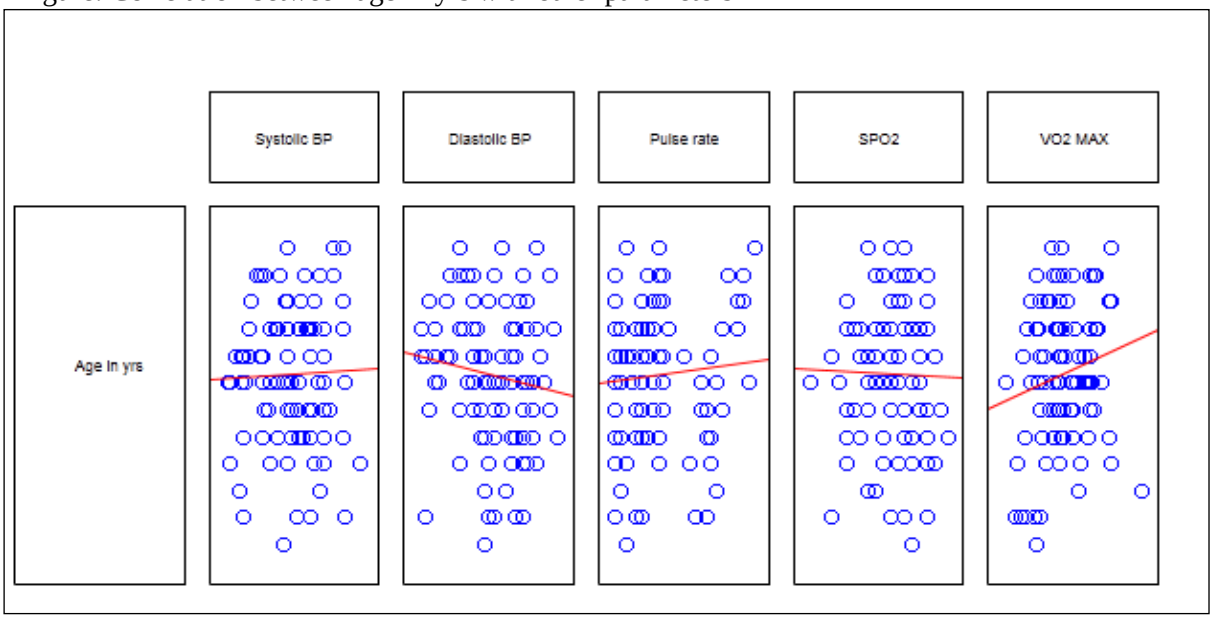


Figure: Correlation between Systolic BP with other parameters



- Figure: Correlation between age in yrs with other parameters



Discussion:

The findings of this study indicate significant alterations in functional status, hemodynamic variables, VO2 max, and SpO2 among pregnant women compared to non-pregnant controls. These changes may have implications for maternal health and warrant further investigation. Understanding the physiological adaptations during pregnancy is crucial for identifying potential risk factors and optimizing maternal and fetal outcomes. The diaphragm is the main muscle for inspiration and is assisted by the intercostals.[7] When the diaphragm contracts, it creates a negative pressure system which facilitates air flowing into the lungs and the chest expands. Minute ventilation is the product of the volume of air brought into the lungs each breath (tidal volume) and the frequency of breathing cycles per minute (respiratory rate). Minute ventilation will increase progressively by 30-50% through pregnancy.[8] This is primarily driven by increasing progesterone levels which relaxes smooth muscle in the upper airways and reduces the partial pressure of carbon dioxide in the alveoli. It is commonly thought that the expanding uterus and upward shifting of internal organs will then compress the lungs and limit lung function, however this is incorrect.[9] Intraabdominal volume does increase by about 1.5 times throughout pregnancy, but the ribcage will also expand and shift upwards and outwards increasing chest circumference by 5-7cm.[10]This shape change allows for a preservation of volume in the thoracic cavity allowing normal lung expansion. There is a 5% decrease in total lung capacity due to a drop in expiratory reserve volume and residual lung volume but vital 4 capacity remains unchanged because of an increase in inspiratory capacity.[11]

Conclusion:

This observational study sheds light on the impact of pregnancy on various physiological parameters, including functional status, hemodynamic variables, VO2 max, and SpO2.[12] The findings underscore the need for continued research in this area to better understand the complex physiological changes during pregnancy and their implications for maternal health. Further studies are warranted to elucidate the mechanisms underlying these changes and develop targeted interventions to optimize maternal and fetal well-being.[13]

Limitation:

1. Small Sample Size: The study may have been limited by a relatively small sample size, which could affect the generalizability of the findings to a larger population of pregnant women. A larger sample size would provide more robust and representative results.[14]
2. Selection Bias: There might have been selection bias due to the recruitment of participants from a specific demographic or healthcare setting, potentially limiting the generalizability of the findings to a broader population of pregnant women.[15]
3. Measurement Bias: Variability in the measurement techniques used for assessing functional status, hemodynamic variables, and VO2 max could introduce measurement bias, impacting the accuracy and reliability of the results.

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