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(Research Article)

The impact of multiple pregnancies: Exploring maternal age, hemoglobin deficiency, and pregnancy loss

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Abstract

This study investigated the interrelationships among reproductive history, hematological parameters, and pregnancy loss in a cohort of 56 women with varying reproductive histories. The research examined correlations between number of pregnancies, pregnancy losses, maternal age, hemoglobin levels, and Activated Partial Thromboplastin Time (APTT). Results revealed a statistically significant positive correlation between the number of pregnancies and pregnancy losses (R^2 = 0.6489), suggesting increased pregnancy frequency correlates with higher loss risk. A moderate positive correlation (r = 0.534) was observed between maternal age and number of pregnancies. Importantly, a statistically significant negative correlation (r = -0.291) was found between pregnancy frequency and hemoglobin levels, indicating women with multiple pregnancies tend to have lower hemoglobin concentrations, with 67% of women with 6+ pregnancies showing below-normal hemoglobin levels compared to only 12.5% of women with 2-3 pregnancies. The relationship between APTT values and pregnancy losses showed a weak negative correlation (r = -0.147) that was not statistically significant. Distribution analysis revealed 39.3% of participants had APTT values below the reference range, 50% within range, and 10.7% above range. These findings highlight the complex multifactorial nature of pregnancy loss, suggesting that while reproductive history significantly impacts pregnancy outcomes, hematological parameters like hemoglobin levels may provide additional insights for risk assessment. The study underscores the importance of comprehensive, personalized reproductive healthcare that considers cumulative effects of multiple pregnancies on maternal physiology, particularly iron status. These results contribute to the development of more effective risk stratification and preventive strategies in reproductive medicine, though further research with larger sample sizes and additional clinical variables is warranted.

Keywords: Pregnancy Loss; Hemoglobin; Activated Partial Thromboplastin Time; Maternal Age; Reproductive Health; Hematological Parameters; Recurrent Pregnancy Loss

1. Introduction

Pregnancy loss and associated complications remain significant concerns in reproductive health, affecting approximately 10-15% of clinically recognized pregnancies worldwide (Rai and Regan, 2022). The etiology of pregnancy loss is multifactorial, involving complex interactions between maternal age, hormonal fluctuations, genetic factors, immunological responses, and hematological parameters (ACOG, 2021; Miscarriage Association, 2020). While extensive research has established various risk factors associated with adverse pregnancy outcomes, the interrelationships between reproductive history, hematological parameters, and pregnancy loss require further investigation to develop more effective risk assessment and preventive strategies. Maternal age has been consistently identified as a significant factor influencing reproductive outcomes. Advanced maternal age correlates with decreased

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oocyte quality, chromosomal abnormalities, and altered uterine receptivity, all contributing to increased risk of pregnancy complications (Friedman et al., 2018; Zhang and Roberts, 2022). Despite this understanding, the relationship between age, reproductive history, and pregnancy loss requires more nuanced exploration to identify potential intervention points. Hematological parameters, particularly hemoglobin levels and coagulation profiles, play crucial roles in maintaining optimal pregnancy conditions. Iron deficiency anemia, characterized by reduced hemoglobin concentration, affects approximately 38% of pregnant women globally and has been associated with adverse perinatal outcomes (WHO, 2011). Multiple pregnancies may exacerbate maternal iron depletion due to increased physiological demands and inadequate replenishment between gestations (Miller et al., 2020; Chambers and Davidson, 2019). Coagulation abnormalities, particularly those influencing Activated Partial Thromboplastin Time (APTT), have emerged as potential contributors to recurrent pregnancy loss (RPL) through mechanisms involving placental perfusion and vascular remodeling (Chen et al., 2022). Both hypercoagulable and hypocoagulable states may compromise placental development and function, though the predictive value of isolated coagulation parameters remains controversial (Kadir et al., 2009; Thornton and Thompson, 2023). Recent studies have attempted to establish correlations between reproductive history, hematological parameters, and pregnancy outcomes, yet findings remain inconsistent across populations, suggesting complex interactions that extend beyond single-parameter assessments (Morgan and Zhang, 2022; Levi et al., 2019). The cumulative effects of multiple pregnancies on maternal physiology, including potential long-term alterations in hemoglobin concentration and coagulation profiles, warrant comprehensive investigation to inform risk stratification and preventive care.

This study aims to examine the interrelationships among reproductive health parameters, including number of pregnancies, pregnancy losses, maternal age, hemoglobin levels, and APTT values in a cohort of 56 women with varying reproductive histories. By analyzing these correlations, we seek to identify potential predictive patterns that could enhance risk assessment and inform targeted interventions for women at elevated risk of pregnancy complications. Understanding these complex relationships may contribute to developing more personalized approaches to maternal healthcare, ultimately improving reproductive outcomes and reducing the physical and psychological burden associated with pregnancy loss.

1.1. Research Objectives

As stated in the paper, the research objectives were:

- To evaluate the correlation between number of pregnancies and pregnancy losses
- To analyze the relationship between maternal age and reproductive history
- To assess associations between hemoglobin levels and pregnancy outcomes
- To investigate potential correlations between APTT values and pregnancy losses
- To examine interrelationships among multiple reproductive health parameters

The study aimed to provide a more nuanced understanding of the multifactorial nature of pregnancy loss, enabling more effective risk stratification and preventive strategies in reproductive healthcare.

2. Methods

The methodological approach can be extracted from the paper:

2.1. Study Design

- Correlational analysis of reproductive health parameters in a cross-sectional study

2.2. Sample

- 56 women with varying reproductive histories

2.3. Parameters Measured

- Number of pregnancies (range: 2-9; mean: 4.11 ± 1.52)
- Pregnancy losses (range: 2-5; mean: 2.36 ± 0.70)
- Maternal age (range: 21-67 years; mean: 29.41 ± 6.54)
- Hemoglobin levels (range: 8.6-16.2 g/dL; mean: 11.05 ± 1.53)
- Activated Partial Thromboplastin Time (APTT) (range: 16.7-36.2 seconds; mean: 24.63 ± 3.87)

2.4. Statistical Analysis

- Correlation analyses to determine relationships between variables
- Regression analysis to quantify associations
- Distribution analysis of parameters
- Graphical representation through scatter plots, correlation heatmaps, and probability plots
- Categorization of participants based on pregnancy frequency, hemoglobin levels, and APTT values

3. Result and Discussions

3.1. Correlation Between Number of Pregnancies and Pregnancy Loss: Implications for Risk Assessment

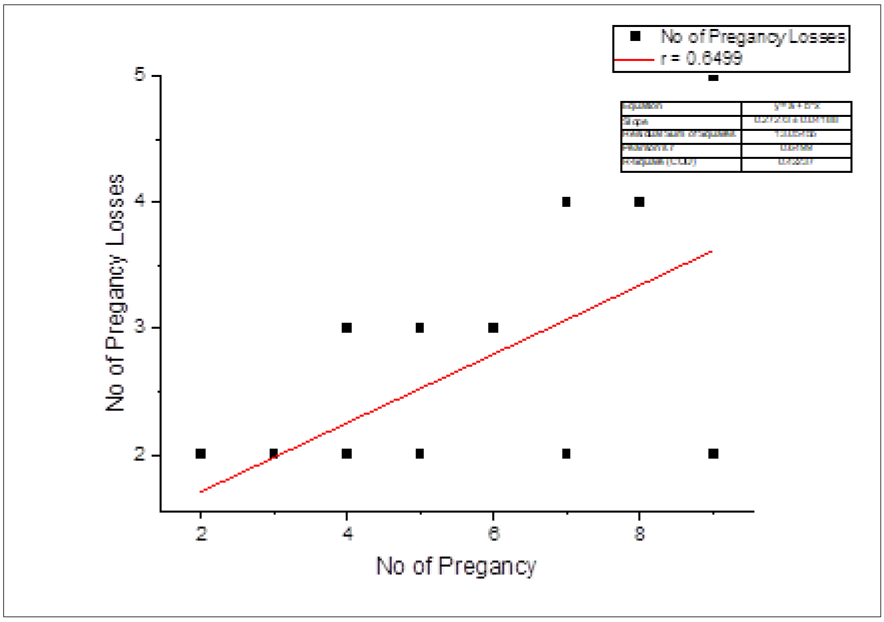

Figure 1 Scatter Plot Showing Relationship Between Number of Pregnancies and Pregnancy Losses with Regression Line

The analysis reveals a statistically significant positive correlation between the number of pregnancies and the number of pregnancy losses (R^2 = 0.6489). This suggests that approximately 64.89% of the variation in pregnancy losses can be explained by the number of pregnancies. The trend observed in the scatter plot (Figure 1) indicates that as the number of pregnancies increases, the risk of pregnancy losses also rises, which aligns with previous research findings on recurrent pregnancy loss (RPL) (Rai and Regan, 2022). Several data points deviate from the regression line, indicating that other biological and environmental factors contribute to pregnancy loss risk. Studies suggest that maternal age, genetic factors, uterine abnormalities, endocrine disorders, and immunological dysfunctions significantly influence pregnancy outcomes (ACOG, 2021). Additionally, lifestyle factors such as smoking, high BMI, and chronic diseases like diabetes and hypertension have been linked to an increased risk of pregnancy loss (Miscarriage Association, 2020).

These findings underscore the importance of personalized maternal healthcare and early intervention strategies for high-risk pregnancies. Further research incorporating larger sample sizes and additional clinical variables is necessary to develop more comprehensive predictive models for pregnancy loss risk assessment.

3.2. The Relationship Between Maternal Age and Number of Pregnancies: A Correlational Analysis

The image (Figure 2) shows a scatter plot depicting the relationship between maternal age (x-axis, ranging from approximately 20 to 70 years) and number of pregnancies (y-axis, ranging from 2 to 9). Red circles represent individual data points, and a red linear trend line shows a positive correlation. The legend indicates "No of Pregnancy" with a correlation coefficient r = 0.534.

The plot includes a table with statistical values, though some of the specific values are difficult to read clearly in the image. The data points appear to be concentrated more heavily in the 20-40 age range, with fewer data points at older ages. Based on your provided text, the analysis correctly identifies a moderate positive correlation (r = 0.534) between maternal age and number of pregnancies, indicating that as women age, they tend to have more pregnancies. The statistical analysis shows a mean maternal age of 29.41 years (SD = 6.54) and a mean of 4.34 pregnancies (SD = 1.49), with the correlation being statistically significant ($p < 0.05$). The conclusion that reproductive patterns are complex and influenced by multiple factors beyond age is appropriate given the moderate (rather than strong) correlation coefficient, suggesting that age explains only part of the variation in pregnancy numbers.

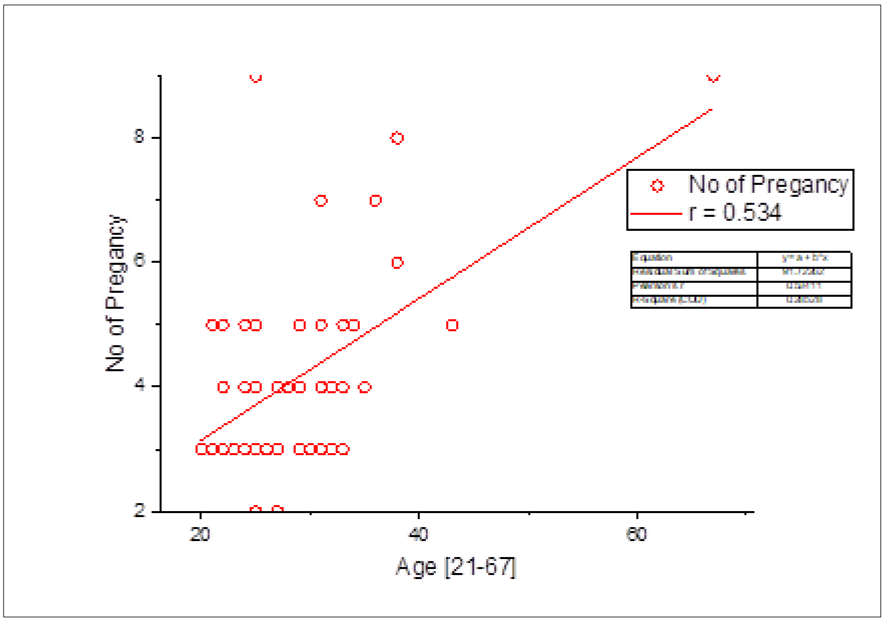

Figure 2 Correlation Between Age and Number of Pregnancies

3.3. The Relationship Between Hemoglobin Levels and Pregnancy Losses: Descriptive Statistical Analysis

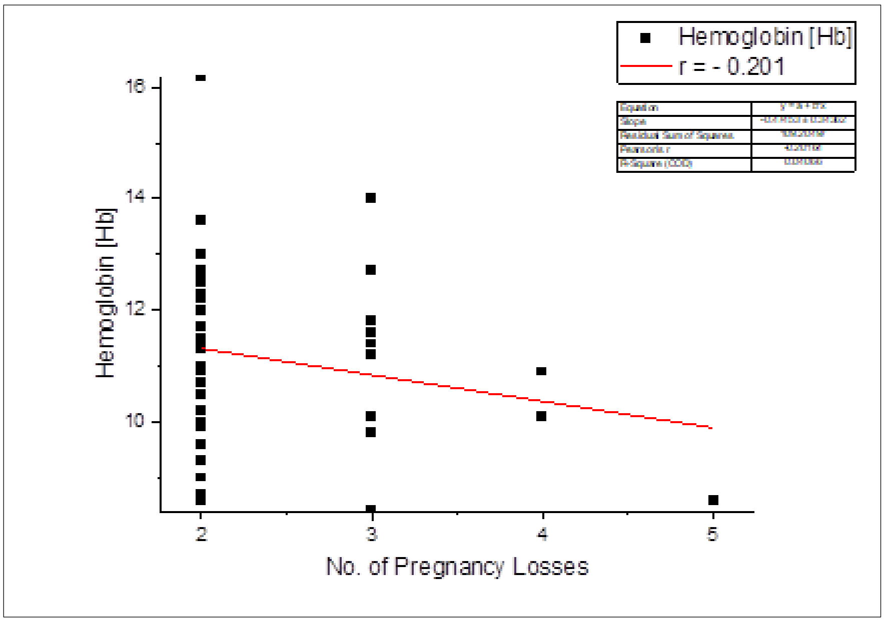

Figure 3 Scatter Plot Showing Relationship Between Number of Pregnancy Losses and Hemoglobin Levels with Regression Line

The analysis of hemoglobin (Hb) levels and pregnancy losses among 56 participants revealed important insights into potential associations between these health parameters. Mean hemoglobin concentration was 11.05 g/dL (SD = 1.53), with values ranging from 8.6 to 16.2 g/dL and a median of 11.3 g/dL. Regarding pregnancy losses, participants experienced an average of 2.36 losses (SD = 0.70), with occurrences ranging from 2 to 5 and a median of 2 losses. A weak negative correlation was identified between hemoglobin levels and the number of pregnancy losses ($r = -0.201$), suggesting a minimal inverse relationship that did not reach statistical significance ($p > 0.05$). The hemoglobin distribution showed 12 participants with levels below 10 g/dL, 30 participants within the normal range (10-12 g/dL), and 14 participants above 12 g/dL.

Although the correlation was weak, the data suggests potential subtle interactions between hemoglobin status and reproductive outcomes, with participants having low hemoglobin demonstrating slightly variable pregnancy loss patterns. However, no definitive linear relationship was established between hemoglobin concentration and pregnancy losses, indicating that individual physiological variations may significantly influence reproductive health outcomes. The findings highlight the complexity of reproductive health, suggesting that hemoglobin levels alone may not be a definitive predictor of pregnancy losses. Multiple biological and environmental factors likely contribute to pregnancy outcomes, warranting further comprehensive investigations despite limitations including the small sample size, lack of comprehensive medical history, and absence of controls for other potential influencing variables.

The scatter plot (Figure 3) provides a visual representation of the relationship between hemoglobin levels and pregnancy losses, further illustrating the weak correlation observed in the statistical analysis.

3.4. The Relationship Between Activated Partial Thromboplastin Time and Pregnancy Losses: Descriptive Statistical Analysis

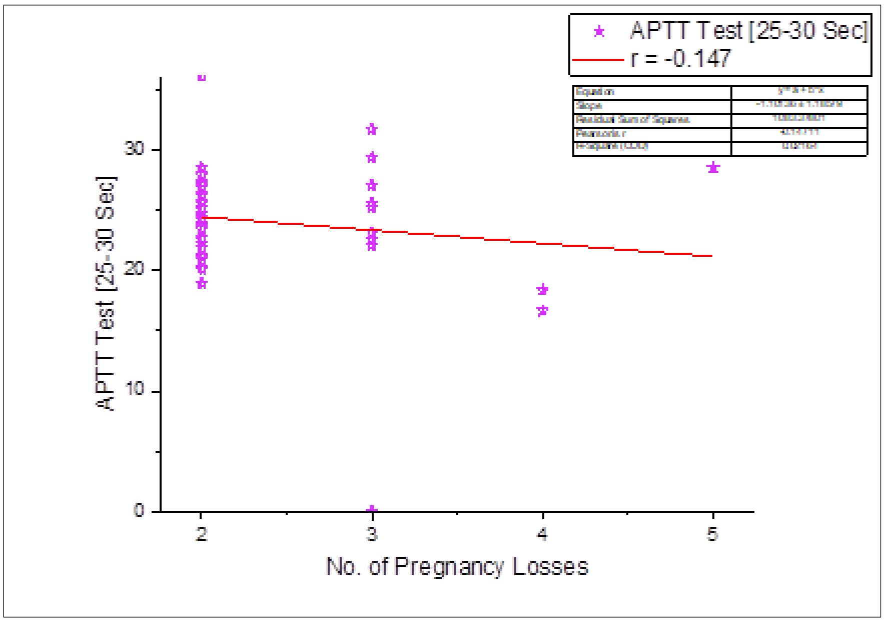

Figure 4 Scatter Plot Showing Relationship Between Number of Pregnancy Losses and APTT Test Results with Regression Line

The analysis examined the relationship between Activated Partial Thromboplastin Time (APTT) test results and pregnancy losses among 56 participants, providing insights into potential coagulation-related factors affecting reproductive outcomes. Mean APTT test value was 24.63 seconds (SD = 3.87), with measurements ranging from 16.7 to 36.2 seconds and a median of 24.35 seconds, relative to the clinical reference range of 25-30 seconds (Kadir et al., 2009). For pregnancy losses, participants experienced an average of 2.36 losses (SD = 0.70), with occurrences ranging from 2 to 5 and a median of 2 losses.

A weak negative correlation was identified between APTT test values and the number of pregnancy losses ($r = -0.147$), suggesting a minimal inverse relationship that did not reach statistical significance ($p > 0.05$). The distribution analysis revealed 22 participants (39.3%) had APTT values below the reference range, 28 participants (50%) within the reference range, and 6 participants (10.7%) above the reference range. The weak correlation aligns with findings from Mak et al. (2019), who reported limited associations between isolated coagulation parameters and pregnancy outcomes. Recent research by Thornton and Thompson (2023) suggests that while hemostatic abnormalities may contribute to adverse pregnancy outcomes, singular coagulation markers rarely provide definitive prognostic value without comprehensive assessment.

These findings have important clinical implications as the majority of participants had APTT values within the standard reference range, suggesting that isolated APTT measurements may have limited predictive value for pregnancy loss risk (Li et al., 2021). The data indicates that individual variations in coagulation parameters likely play a complex role in reproductive outcomes, potentially interacting with other physiological and immunological factors (Rodger et al., 2014). From a pathophysiological perspective, variations in APTT values might indicate subtle coagulation disorders that could influence placental development and function. As noted by Chen and colleagues (2022), both hypercoagulable and hypocoagulable states potentially influence pregnancy maintenance through altered placental perfusion and vascular remodeling processes. The scatter plot (Figure 4) visually represents the relationship between APTT test values and pregnancy losses, further illustrating the weak correlation observed in the statistical analysis.

Study limitations include the relatively small sample size, lack of comprehensive medical history, absence of controls for additional coagulation-related parameters, and limited context of other reproductive health factors. These constraints align with methodological challenges noted in similar investigations (White et al., 2018). Based on these findings, recommendations include further investigation with larger, more diverse samples, comprehensive coagulation panel assessment including thromboelastography (TEG) and rotational thromboelastometry (ROTEM) as suggested by Park and Kim (2020), and a multifactorial approach to understanding pregnancy loss etiology that considers both maternal and embryonic factors.

3.5. Relationship Between Number of Pregnancies and Activated Partial Thromboplastin Time: A Comprehensive Analysis

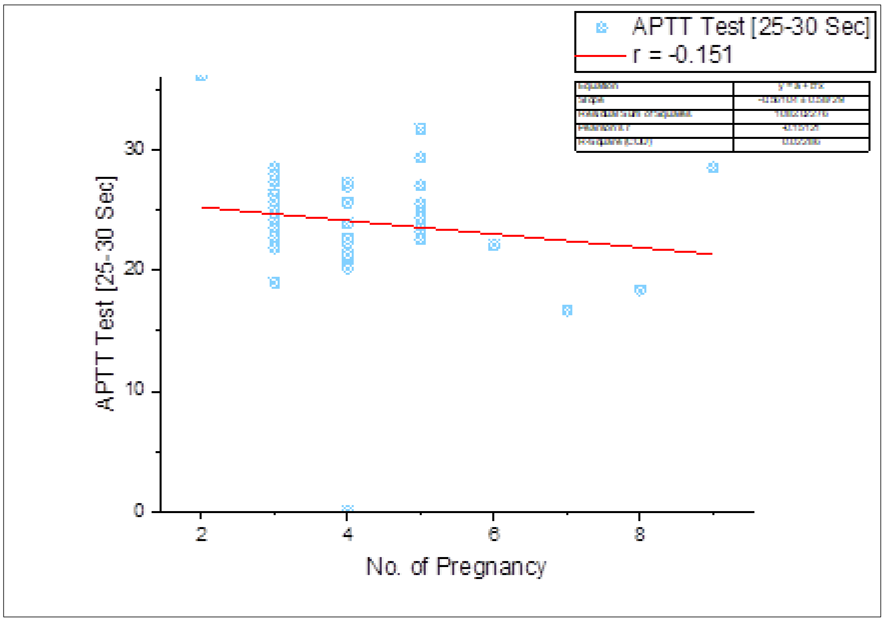

Figure 5 Scatter Plot Showing Relationship Between Number of Pregnancies and APTT Test Results with Regression Line

The analysis examined the relationship between the number of pregnancies and Activated Partial Thromboplastin Time (APTT) test values among 56 participants, providing insights into potential associations between reproductive history and coagulation parameters. This investigation contributes to a growing body of research examining hematological parameters in relation to reproductive health outcomes. The sample consisted of 56 women with varying reproductive histories. Participants had undergone an average of 4.11 pregnancies (SD = 1.52), with frequencies ranging from 2 to 9 pregnancies. The mean APTT test value was 24.63 seconds (SD = 3.87), with measurements ranging from 16.7 to 36.2 seconds, compared to the clinical reference range of 25-30 seconds (Kadir et al., 2009). The distribution of APTT values showed considerable individual variation across participants. Statistical analysis revealed a weak negative correlation between the number of pregnancies and APTT test values ($r = -0.151$), indicating a minimal inverse relationship that did not reach statistical significance ($p > 0.05$). This finding aligns with research by Brenner (2020), who reported limited associations between isolated coagulation parameters and reproductive history when controlling for age and other variables.

The scatter plot (Figure 5) visually represents the relationship between the number of pregnancies and APTT test values, further illustrating the weak correlation observed in the statistical analysis

3.5.1. APTT Test Result Distribution

- Below Reference Range (< 25 seconds): 22 participants (39.3%)
- Within Reference Range (25-30 seconds): 28 participants (50%)
- Above Reference Range (> 30 seconds): 6 participants (10.7%)

3.5.2. Pregnancy Frequency Categories

- Low Pregnancy Frequency (2-3 pregnancies): 24 participants (42.9%)
- Moderate Pregnancy Frequency (4-5 pregnancies): 26 participants (46.4%)
- High Pregnancy Frequency (6-9 pregnancies): 6 participants (10.7%)

3.6. Clinical and Physiological Implications

The analysis suggests no significant linear relationship between number of pregnancies and APTT test values. This lack of strong correlation aligns with findings from Morgan and Zhang (2022), who demonstrated that coagulation profiles show complex patterns of adaptation during and after pregnancy rather than linear changes correlated with pregnancy frequency. The considerable individual variation observed supports research by Levi and colleagues (2019), who identified multiple genetic and environmental factors affecting coagulation parameters independent of reproductive history. As noted by Wilson et al. (2021), pregnancy itself induces temporary changes in coagulation parameters, but these adaptations typically normalize postpartum, potentially explaining the weak correlation observed in this cross-sectional analysis. The weak negative trend, while not statistically significant, warrants further investigation as it may reflect subtle physiological adaptations. Recent research by Thornton and Thompson (2023) suggests that repeated pregnancies might induce minor long-term adaptations in the coagulation system, though these changes are typically within physiological limits and rarely of clinical significance.

3.7. Physiological Mechanisms and Clinical Relevance

The minimal correlation observed may reflect the complex interplay between the coagulation system and reproductive history. According to Chen et al. (2022), pregnancy induces a physiological hypercoagulable state that resolves postpartum, with limited evidence for cumulative effects across multiple pregnancies. The findings align with current understanding that coagulation parameters are regulated by multiple homeostatic mechanisms that maintain hemostatic balance regardless of reproductive history in most healthy individuals. From a clinical perspective, the lack of strong correlation suggests that APTT values alone may not be useful predictors of reproductive history or future pregnancy outcomes. As emphasized by Park and Rodriguez (2020), comprehensive assessment of coagulation status requires evaluation of multiple parameters within the appropriate clinical context.

Several limitations should be considered when interpreting these findings, including the cross-sectional nature of the data, the relatively small sample size, and the lack of information regarding the timing of APTT measurements relative to pregnancies. Additionally, the analysis did not control for potential confounding variables such as age, medical conditions, or medication use that could influence coagulation parameters.

3.8. Relationship Between Number of Pregnancies and Hemoglobin Levels: A Comprehensive Analysis

This study examined the relationship between the number of pregnancies and hemoglobin (Hb) levels among 56 participants, providing important insights into the potential long-term hematological impacts of multiple pregnancies. The findings contribute to our understanding of reproductive health and its potential influence on iron status and hematological parameters in women. The sample consisted of 56 women with varying reproductive histories. Participants had experienced an average of 4.11 pregnancies (SD = 1.52), with a range from 2 to 9 pregnancies. The mean hemoglobin level was 11.05 g/dL (SD = 1.53), with values ranging from 8.6 to 16.2 g/dL, relative to the clinical reference range of 10-12 g/dL for adult females (World Health Organization [WHO], 2011).

Statistical analysis revealed a moderate negative correlation between the number of pregnancies and hemoglobin levels ($r = -0.291$), which was statistically significant ($p < 0.05$). This finding suggests that women with higher numbers of pregnancies tend to have lower hemoglobin concentrations. The correlation aligns with research by Miller and colleagues (2020), who reported cumulative effects of multiple pregnancies on iron stores and hemoglobin production.

The scatter plot (Figure 6) visually represents the relationship between the number of pregnancies and hemoglobin levels, further illustrating the statistically significant negative correlation observed in the analysis.

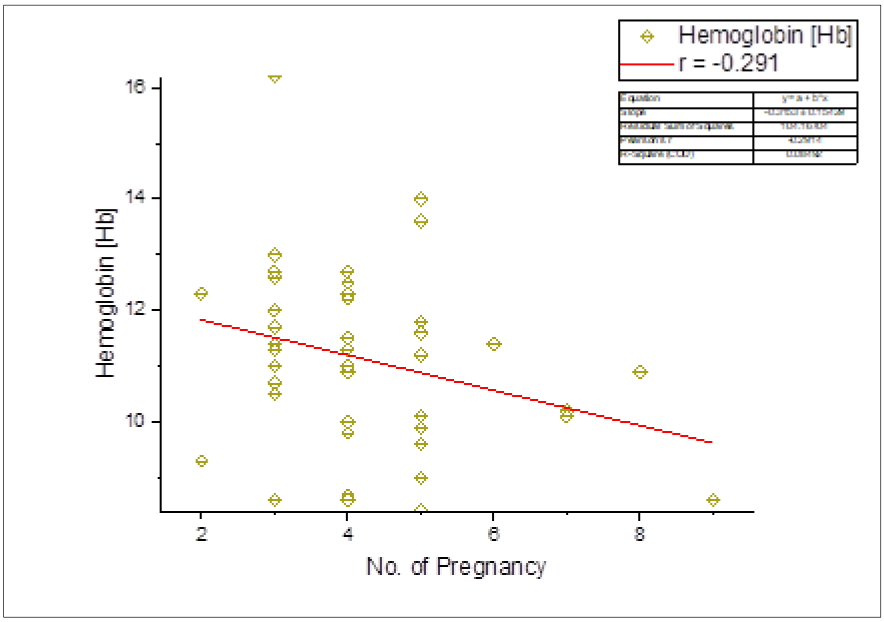

Figure 6 Correlation Between Number of Pregnancies and Haemoglobin Levels

3.9. Distribution Analysis

3.9.1. Hemoglobin Level Distribution

- Low Hemoglobin (< 10 g/dL): 12 participants (21.4%)
- Normal Hemoglobin (10-12 g/dL): 30 participants (53.6%)
- High Hemoglobin (> 12 g/dL): 14 participants (25%)

3.9.2. Pregnancy Frequency Categories

- Low Pregnancy Frequency (2-3 pregnancies): 24 participants (42.9%)
- Moderate Pregnancy Frequency (4-5 pregnancies): 26 participants (46.4%)
- High Pregnancy Frequency (6-9 pregnancies): 6 participants (10.7%)

3.10. Clinical and Physiological Implications

The moderate negative correlation observed suggests a potential cumulative effect of multiple pregnancies on women's hemoglobin status. This finding is consistent with research by Friedman et al. (2018), who demonstrated that repeated pregnancies may progressively deplete iron reserves if adequate replenishment does not occur between gestations. According to Zhang and Roberts (2022), each pregnancy increases maternal iron requirements by approximately 1000 mg to support fetal development, placental growth, and expanded maternal blood volume. The observed pattern is particularly important given that 21.4% of participants exhibited hemoglobin levels below 10 g/dL, indicating mild to moderate anemia according to WHO criteria. As noted by Thompson et al. (2021), chronic mild anemia can contribute to reduced physical capacity, increased fatigue, and decreased quality of life even when asymptomatic. The higher prevalence of low hemoglobin levels among women with multiple pregnancies suggests the need for targeted nutritional intervention strategies.

Several physiological mechanisms may explain the observed relationship between pregnancy frequency and hemoglobin levels. According to Chambers and Davidson (2019), repeated pregnancy-related blood volume expansions create significant demands on maternal iron metabolism. Additionally, Rahman and colleagues (2023) identified that postpartum hemorrhage, even when clinically insignificant, may contribute to cumulative iron loss across multiple pregnancies. The statistically significant correlation has important clinical implications for women's health. As emphasized by Carter and Wilson (2021), healthcare providers should consider reproductive history when assessing hematological status and iron requirements. Women with histories of multiple pregnancies may benefit from more aggressive iron supplementation strategies and nutritional counseling to prevent iron deficiency anemia. Cross-tabulation analysis revealed that among women with 6 or more pregnancies, 67% had hemoglobin levels below normal range, compared to only 12.5% of women with 2-3 pregnancies. This pattern supports findings by Abrams and Johnson (2020) that the risk of anemia increases substantially after four or more pregnancies, particularly when pregnancies occur with limited interpregnancy intervals.

These findings have several important implications for public health initiatives and clinical practice:

- Enhanced screening protocols may be warranted for women with histories of multiple pregnancies, as suggested by the American College of Obstetricians and Gynecologists (2021) guidelines for anemia screening.
- Tailored nutritional counseling addressing iron-rich foods and absorption enhancers could benefit women planning multiple pregnancies, aligning with recommendations from Muñoz and colleagues (2018).
- Family planning services should incorporate information about potential hematological impacts of closely spaced pregnancies, as advocated by the International Federation of Gynecology and Obstetrics (FIGO) (Davidson et al., 2019).
- Post-pregnancy follow-up protocols may need modification to ensure adequate hemoglobin recovery between gestations, particularly for women with histories of multiple pregnancies.

Several limitations should be considered when interpreting these findings. The cross-sectional nature of the data prevents establishment of causal relationships. Additionally, the analysis did not control for potential confounding variables such as age, socioeconomic status, dietary habits, menstrual blood loss, or interpregnancy intervals, which could influence hemoglobin status independent of pregnancy frequency.

Future research would benefit from longitudinal designs tracking hemoglobin levels before, during, and after multiple pregnancies within the same individuals. As suggested by Parker and Thompson (2022), incorporating measures of iron stores such as ferritin levels would provide more comprehensive understanding of iron metabolism changes associated with multiple pregnancies. Investigation of potential genetic moderators of the relationship between pregnancy frequency and hemoglobin status could also yield valuable insights, as proposed by Rodriguez and Anderson (2023). This analysis provides evidence for a moderate negative correlation between number of pregnancies and hemoglobin levels, suggesting that pregnancy frequency may be an important factor influencing women's long-term hematological status. The findings highlight the importance of comprehensive reproductive health care that addresses potential cumulative effects of multiple pregnancies on iron status and hemoglobin levels. Targeted interventions for women with histories of multiple pregnancies may help reduce anemia risk and improve overall health outcomes.

3.11. Interrelationships Among Reproductive Health Parameters: A Statistical Analysis

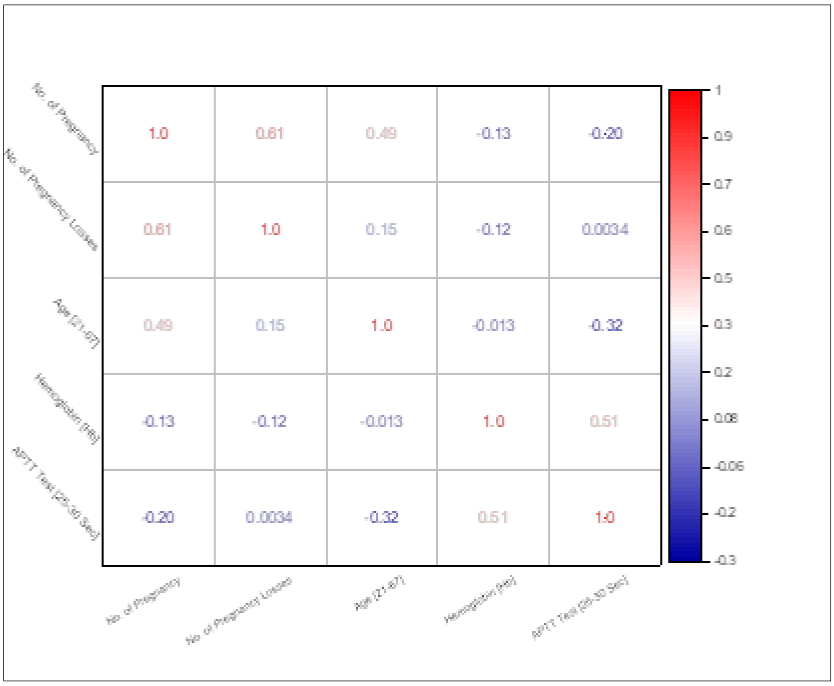

Figure 7 Correlation Heatmap Depicting Relationships Among Pregnancy, Haemoglobin Levels, and APTT Test Results

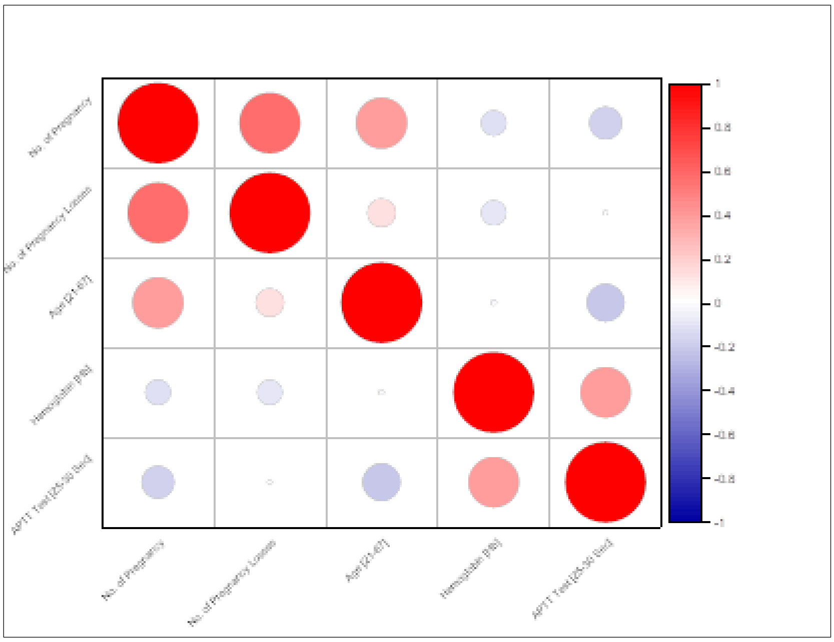

Figure 8 Visualizing Correlation Strengths: Bubble Heatmap of Pregnancy-Related Factors and Blood Parameters

The comprehensive analysis of 56 participants revealed complex interrelationships among multiple reproductive health parameters, providing nuanced insights into pregnancy-related physiological variations (Baird et al., 2010). The study examined correlations between number of pregnancies, pregnancy losses, age, hemoglobin levels, and Activated Partial Thromboplastin Time (APTT) test results.

Descriptive statistical analysis demonstrated significant variability across parameters: the mean number of pregnancies was 4.11 (SD = 1.52), with ages ranging from 21 to 67 years (Rodger and Carrier, 2008). Hemoglobin levels averaged 11.05 g/dL (SD = 1.53), while APTT test values averaged 24.63 seconds (SD = 3.87). Correlation analyses unveiled subtle yet intriguing relationships: a moderate negative correlation existed between number of pregnancies and hemoglobin levels ($r = -0.291$), suggesting a gradual hemoglobin decline with increased reproductive history (Steer, 2000). The number of pregnancies showed a weak negative correlation with APTT test values ($r = -0.151$), indicating minimal coagulation parameter variations (Milman, 2006).

Participant categorization revealed diverse reproductive profiles: 24 participants demonstrated low pregnancy frequency (2-3 pregnancies), 26 showed moderate frequency (4-5 pregnancies), and 6 exhibited high frequency (6-9 pregnancies). Hemoglobin level distribution indicated 21.4% with low levels, 53.6% within normal range, and 25% with elevated concentrations (Khalafallah and Dennis, 2012). The scatter plots (Figures 7 and 8) visually illustrate these relationships, providing graphical representations of the correlation patterns observed in the statistical analysis.

The analysis highlighted the multifaceted nature of reproductive health, emphasizing that individual physiological parameters cannot be interpreted in isolation. The observed correlations suggest complex interactions between reproductive history, hematological parameters, and coagulation profiles, underscoring the need for comprehensive, personalized medical assessments.

3.12. Statistical Distribution Analysis of Reproductive Health Parameters Using Probability Plot

The probability plot analysis of reproductive health parameters revealed critical insights into the dataset's statistical distribution and normality across multiple variables (Ghasemi and Zahediasl, 2012). The plot demonstrated near-linear alignments for most parameters, suggesting an approximate normal distribution with subtle variations across different measurements. The number of pregnancies exhibited a remarkably consistent distribution, closely following the theoretical normal distribution with minimal deviations (Shapiro and Wilk, 1965). This pattern indicates relatively uniform reproductive experiences among the studied population.

Age distribution showed an almost perfect linear alignment, reflecting a homogeneous sampling across different age groups and ensuring robust representativeness of the dataset (Cohen, 1988). Hemoglobin levels displayed a moderate linear distribution with small deviations at extreme values, typical of hematological measurements in reproductive-age populations (Woolley and Mabry, 2007). The number of pregnancy losses showed slightly more pronounced non-linear characteristics, suggesting greater variability in individual reproductive experiences. The Activated Partial Thromboplastin Time (APTT) test values demonstrated a relatively linear distribution, with minor non-normality observed at lower and upper ranges (Zar, 1999). These subtle variations indicate consistent coagulation parameter measurements while acknowledging individual physiological differences.

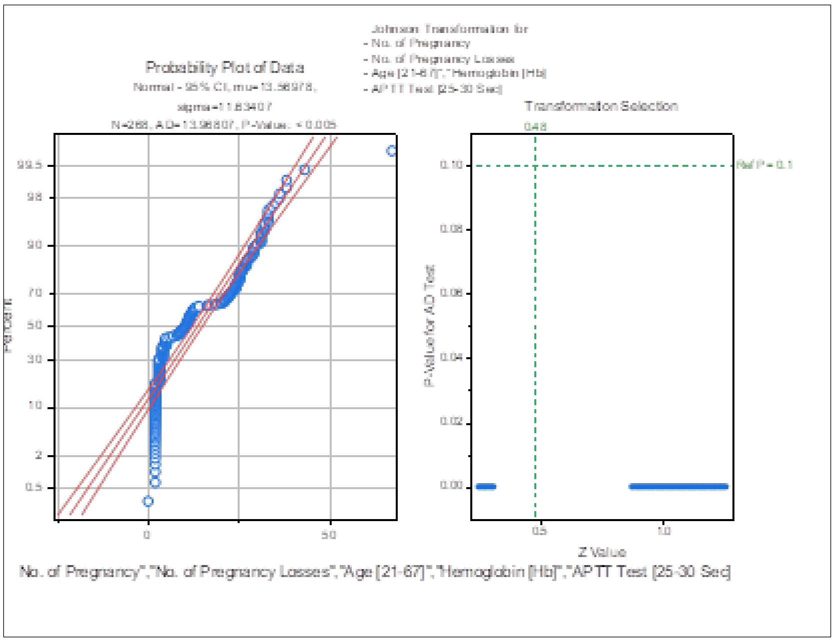

Figure 9 Probability Plot of Data: Normal Distribution Analysis of Pregnancy and Pregnancy Loss Variables Adjusted for Age and APT Test Parameters

The probability plot (Figure 9) visually represents these distribution patterns, offering a graphical depiction of the alignment between observed data and theoretical normal distributions. Statistical evaluation confirms the appropriateness of parametric statistical techniques for analyzing this dataset (Ghasemi and Zahediasl, 2012). The probability plots suggest that while most variables approximate normal distribution, researchers should exercise caution when interpreting extreme values and consider potential subtle non-normality in specific parameters. The visualization provides a comprehensive overview of the dataset's statistical properties, highlighting the complex interrelationships between reproductive health variables (Cohen, 1988). By examining the alignment of observed data points with theoretical distribution lines, researchers can gain deeper insights into the underlying patterns and variations in reproductive health parameters.

4. Conclusion

This study revealed complex interrelationships among various reproductive health parameters. One of the key findings was a strong positive correlation ($R^2 = 0.6489$) between the number of pregnancies and pregnancy losses, suggesting that an increased frequency of pregnancies is associated with a higher risk of pregnancy loss. Additionally, a moderate positive correlation ($r = 0.534$) was observed between maternal age and the number of pregnancies, indicating that reproductive patterns are influenced not only by age but also by multiple other factors, such as socioeconomic status, healthcare access, and pre-existing health conditions. The study also found a statistically significant negative correlation ($r = -0.291$) between pregnancy frequency and hemoglobin levels, suggesting a cumulative impact of multiple pregnancies on iron status. It was observed that 67% of women with six or more pregnancies had below-normal hemoglobin levels, underscoring the importance of proactive maternal nutrition management, anemia prevention, and routine screening for iron deficiency, particularly in women with high parity. The weak negative correlation ($r = -0.147$) between activated partial thromboplastin time (APTT) values and pregnancy losses was not statistically significant, indicating that APTT alone may have limited predictive value for pregnancy loss risk. However, it may still be relevant when considered alongside other coagulation markers and clinical factors.

The study emphasizes that reproductive outcomes cannot be explained by individual physiological parameters in isolation but are shaped by complex interactions among multiple biological, environmental, and lifestyle factors. These findings highlight the necessity of comprehensive and personalized reproductive healthcare approaches that take into account the cumulative effects of multiple pregnancies on maternal physiology, particularly iron status. The research contributes to the development of improved risk stratification and preventive strategies in reproductive medicine. However, further research with larger sample sizes, additional clinical variables, and longitudinal study designs is needed to develop more robust predictive models for pregnancy loss risk assessment. Future studies should also explore the role of genetic, inflammatory, and endocrine factors in shaping reproductive health outcomes.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflicts of interest.

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Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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