MOMMA

(Modeling of Measurable Maternal Attributes)

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MATH 579: Mathematical Modeling
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Topics of Research

- The connections between maternal conditions and placenta weight

- Implementation of Statistical Analysis and Principal Component Analysis

- Different combinatorial indicators of placental growth
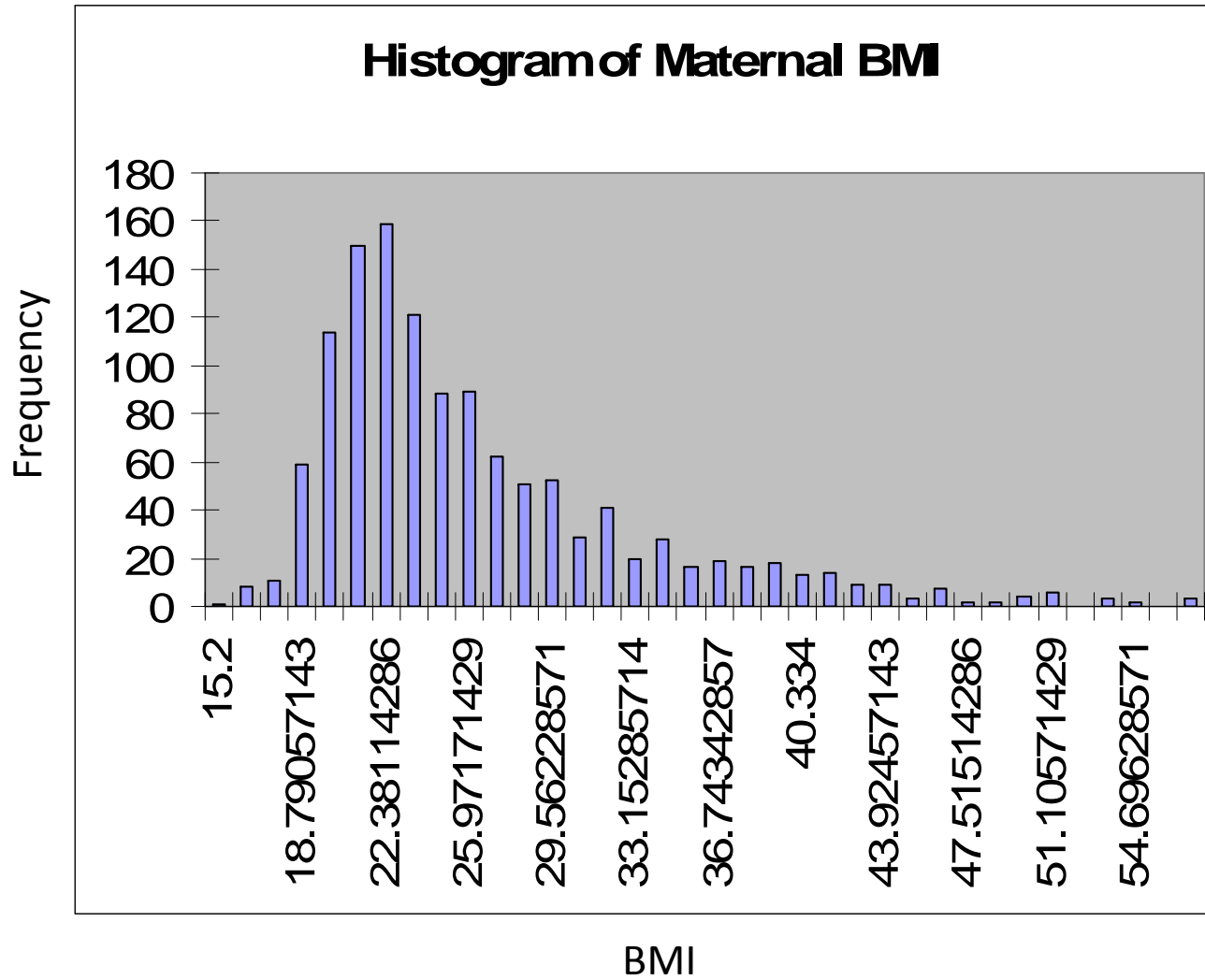
Maternal Variables

- Maternal Pre-Pregnancy BMI
- Maternal Age
- Mother's Ethnicity
- Gestational Diabetes
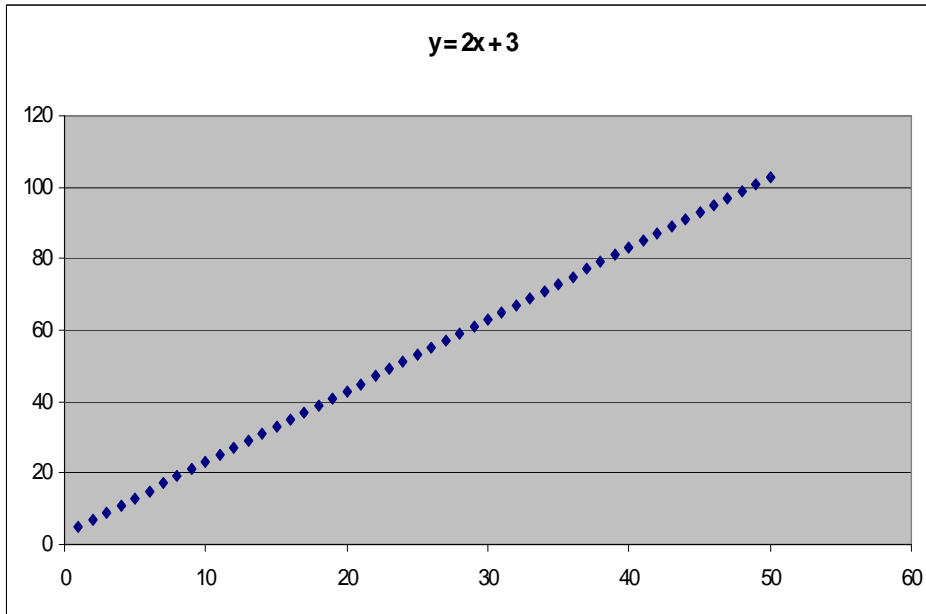
What is Placental Ratio?

Placental Ratio = <u>Placental Weight</u>
Birth Weight
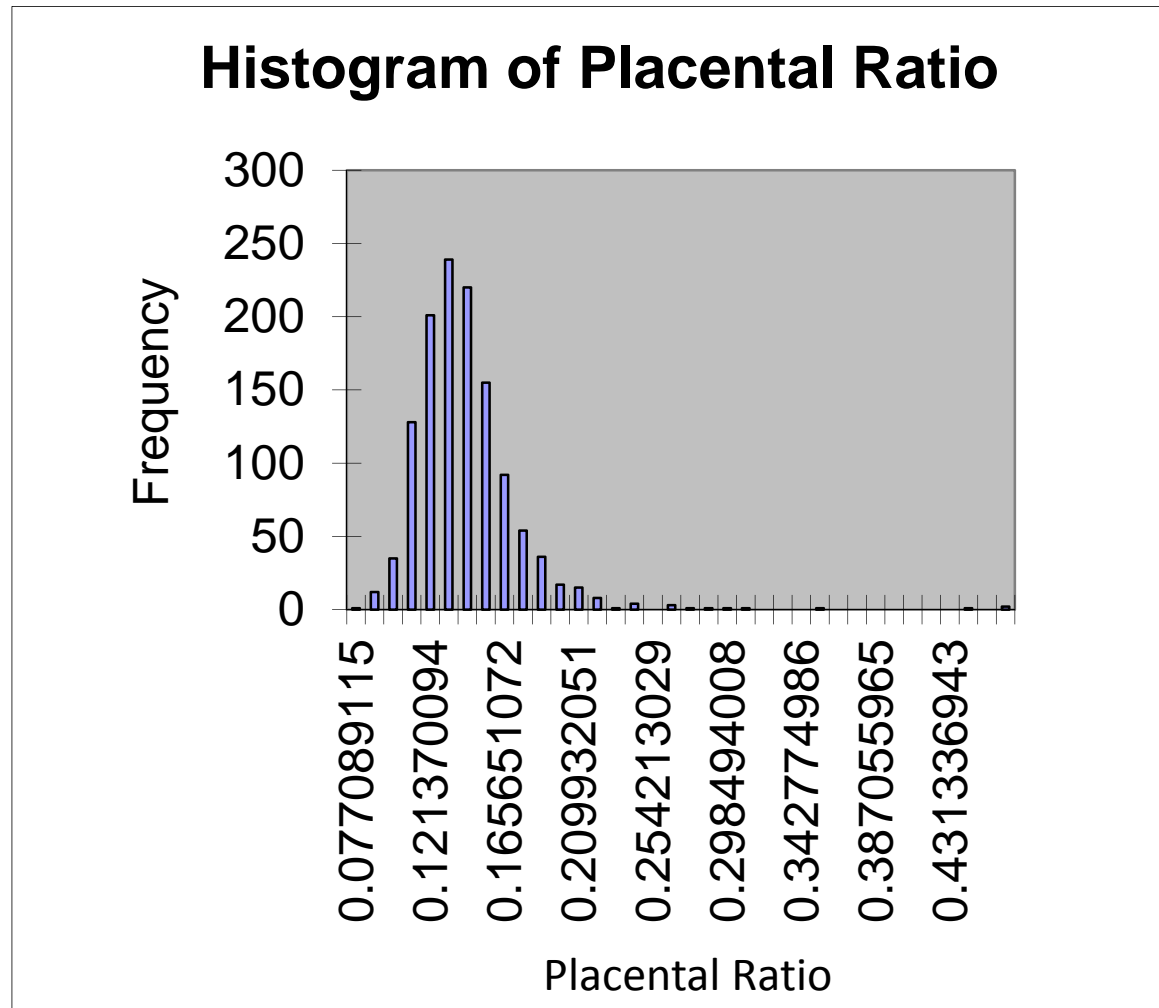
What is the average Maternal BMI?

Histogram of Maternal BMI
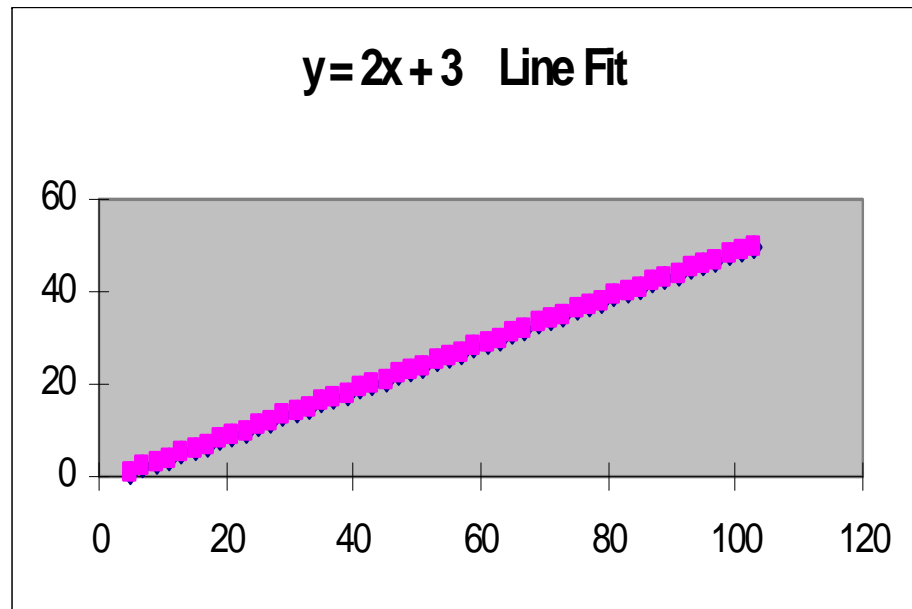
R² and F significance values

y = 2x + 3

y = 2x + 3   Line Fit

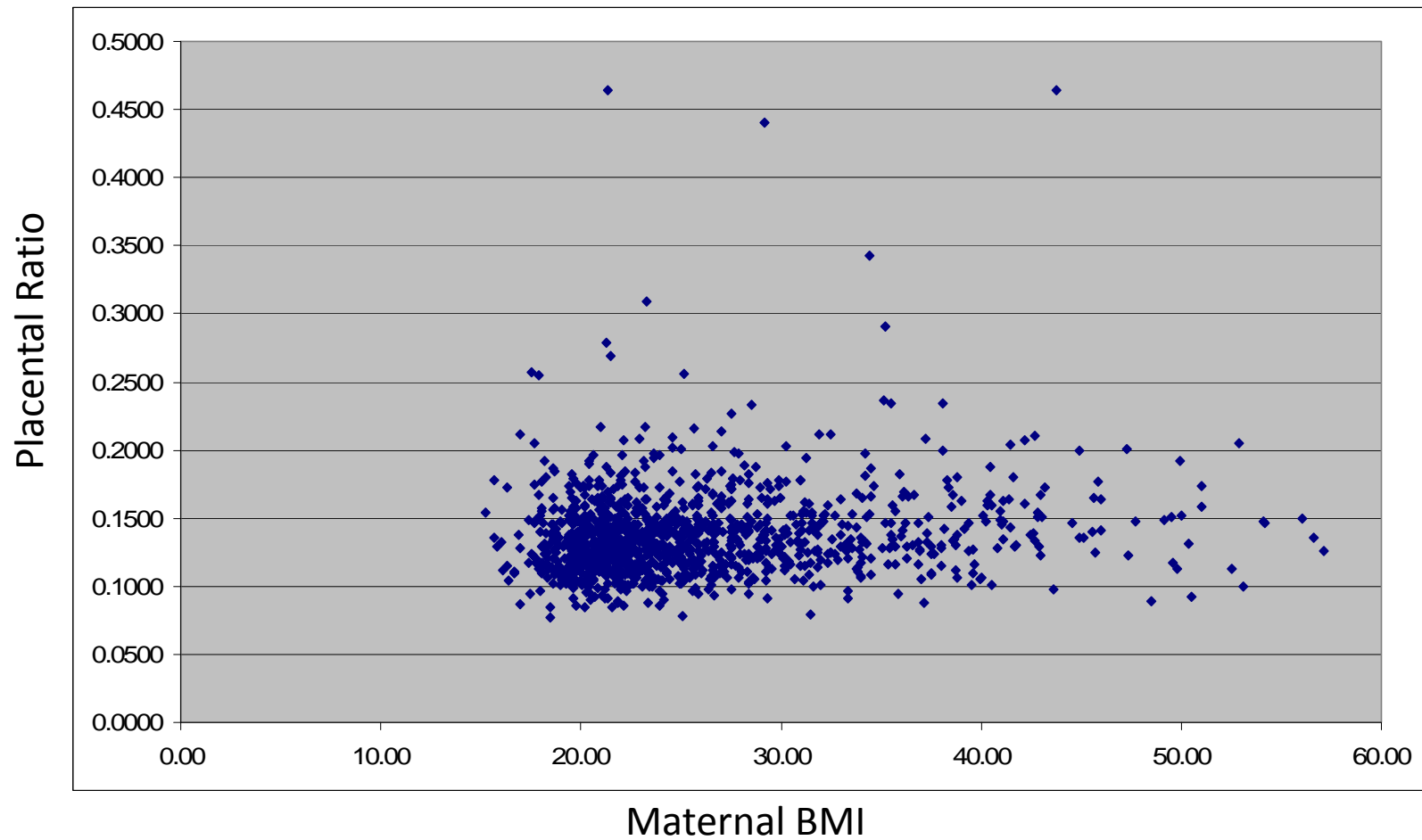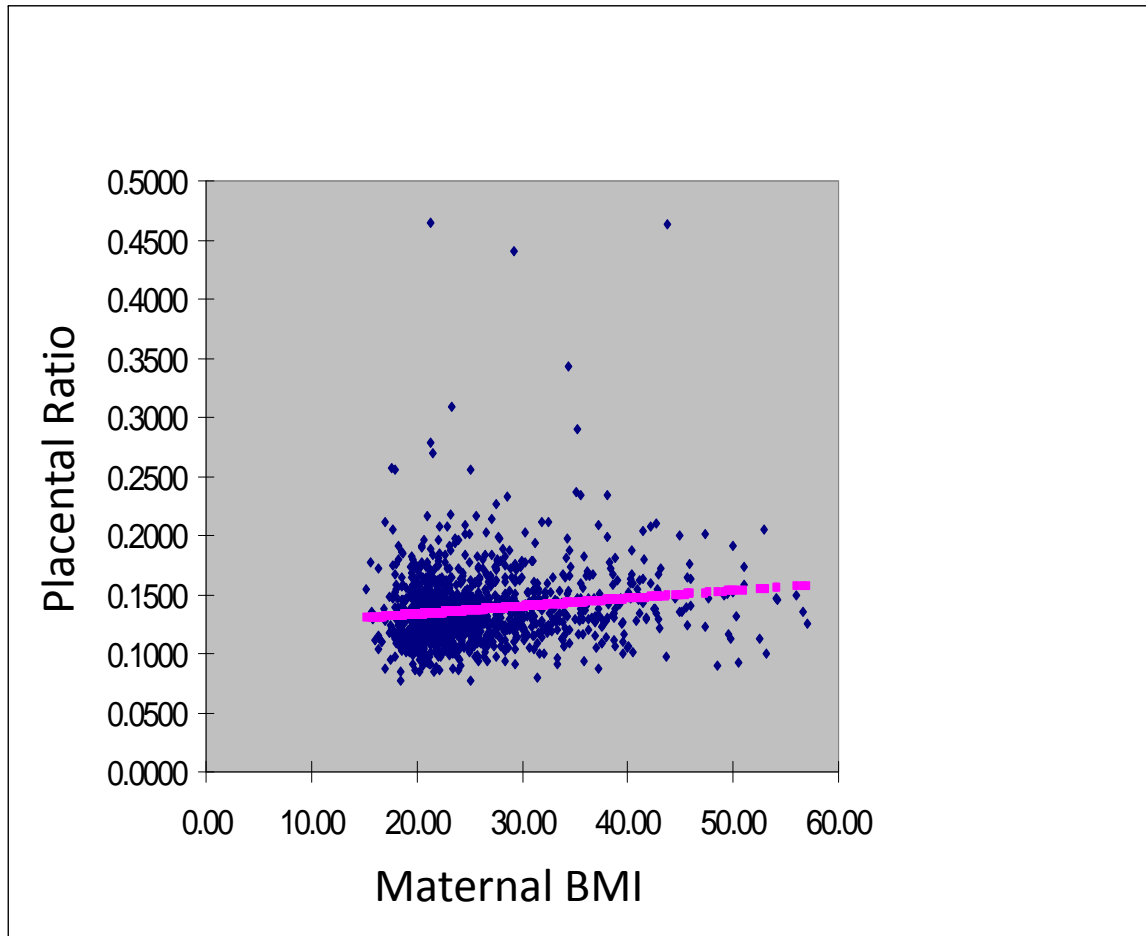R² value= 1

F significance = 0

Maternal BMI vs. Placental Ratio
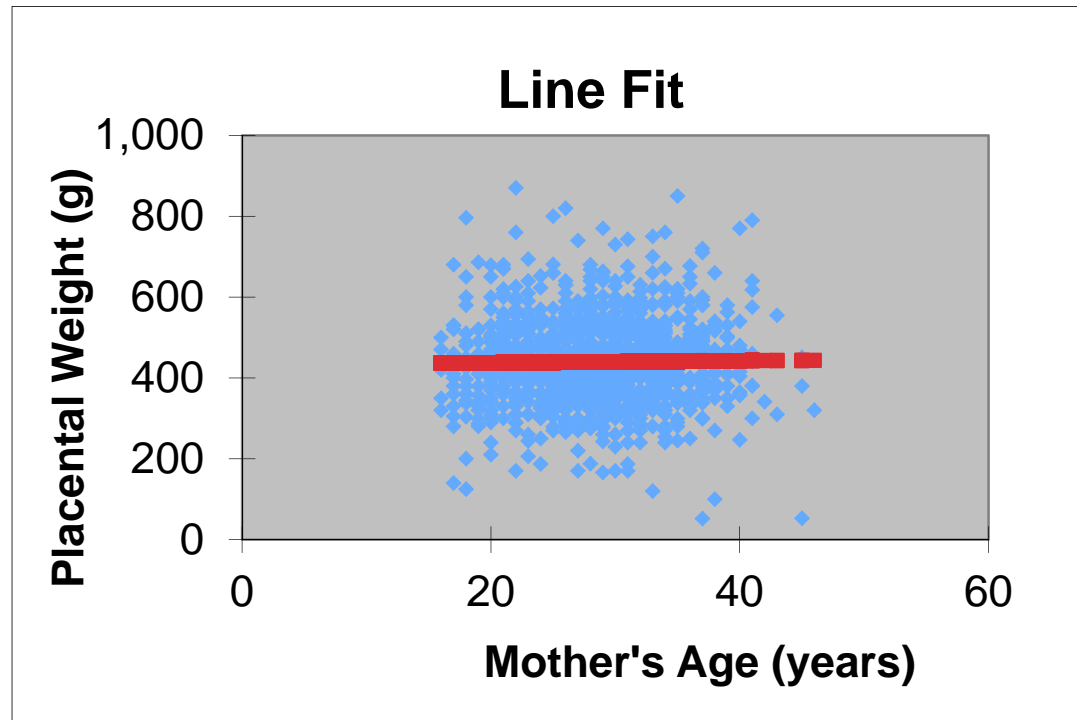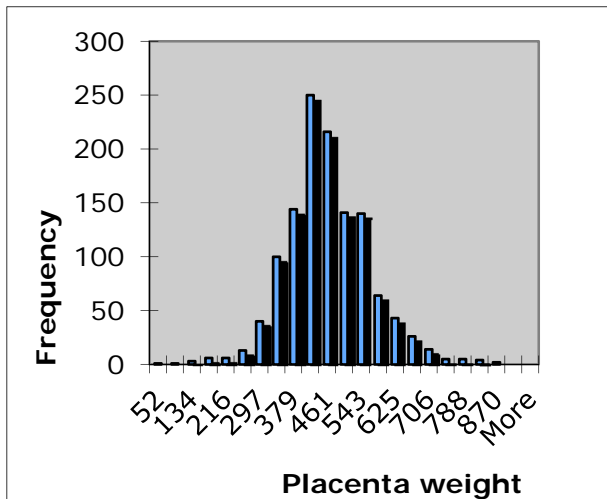
Maternal BMI vs. Placental Ratio Line Fit Plot

R² value= .020921

F significance = 3.54E-07

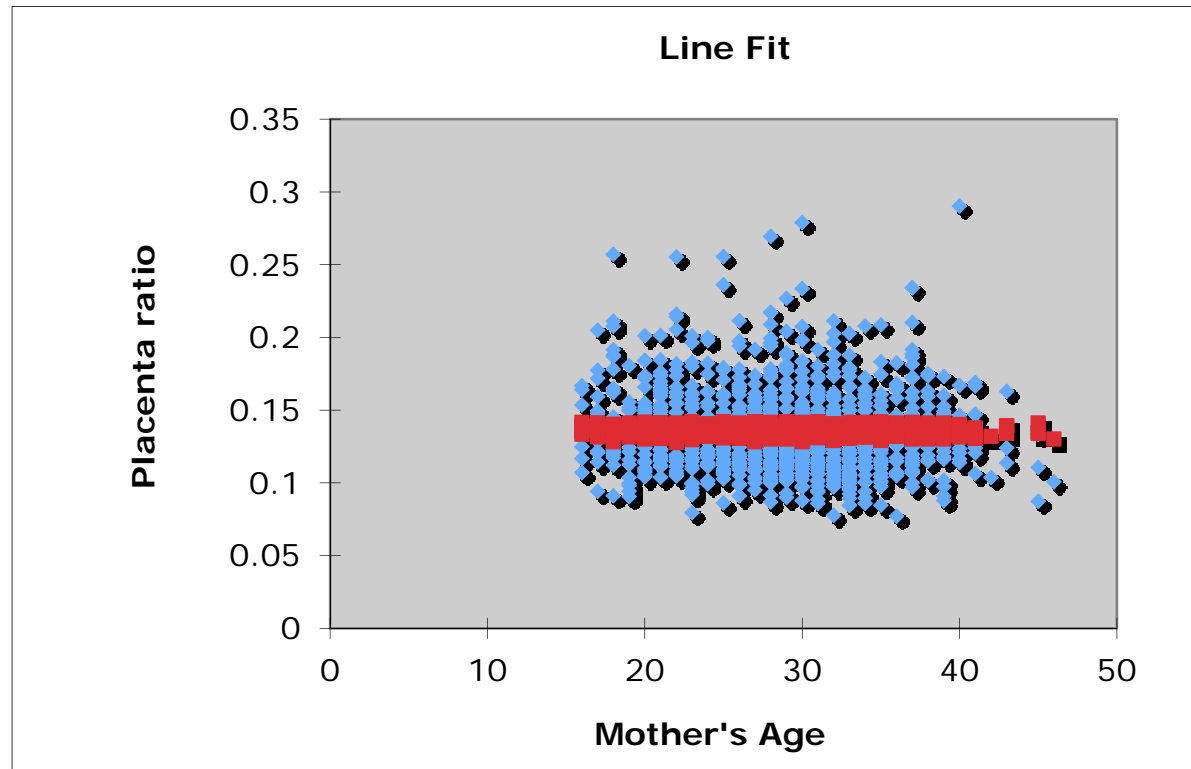Conclusion: A linear correlation exists between Maternal BMI and Placental Ratio.

Maternal Age and Placenta Weight

Maternal Age and Placenta Ratio
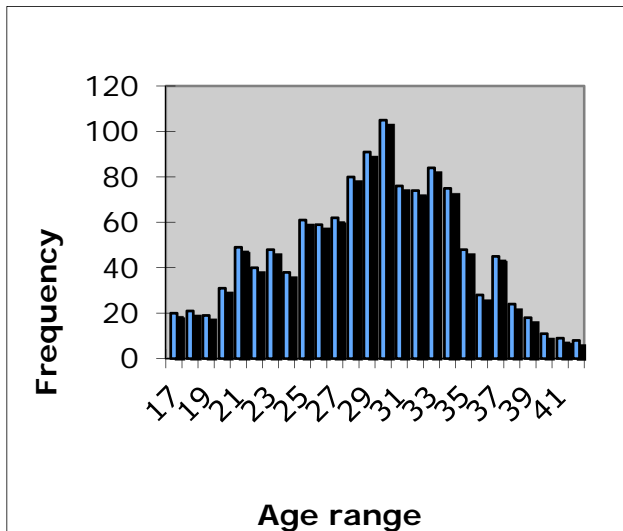
Statistical Results
R^2 value: 0.01
F-stat P-value: 0.0005

Line Fit

Conclusions
• There is a statistically significant correlation between maternal age and placenta ratio. However, the relationship is so weak that a linear fit is basically useless.

Mother's Ethnicity

- Highest average placenta weight with white mothers (449.49±101.94)

- Lowest average placenta weight with African American mothers (418.81±115.79)

Average Placenta Weight by Ethnicity

Ethnicity

■ White   ■ African American   ■ American Indian   ■ Asian/Pacific Islander   ■ Other
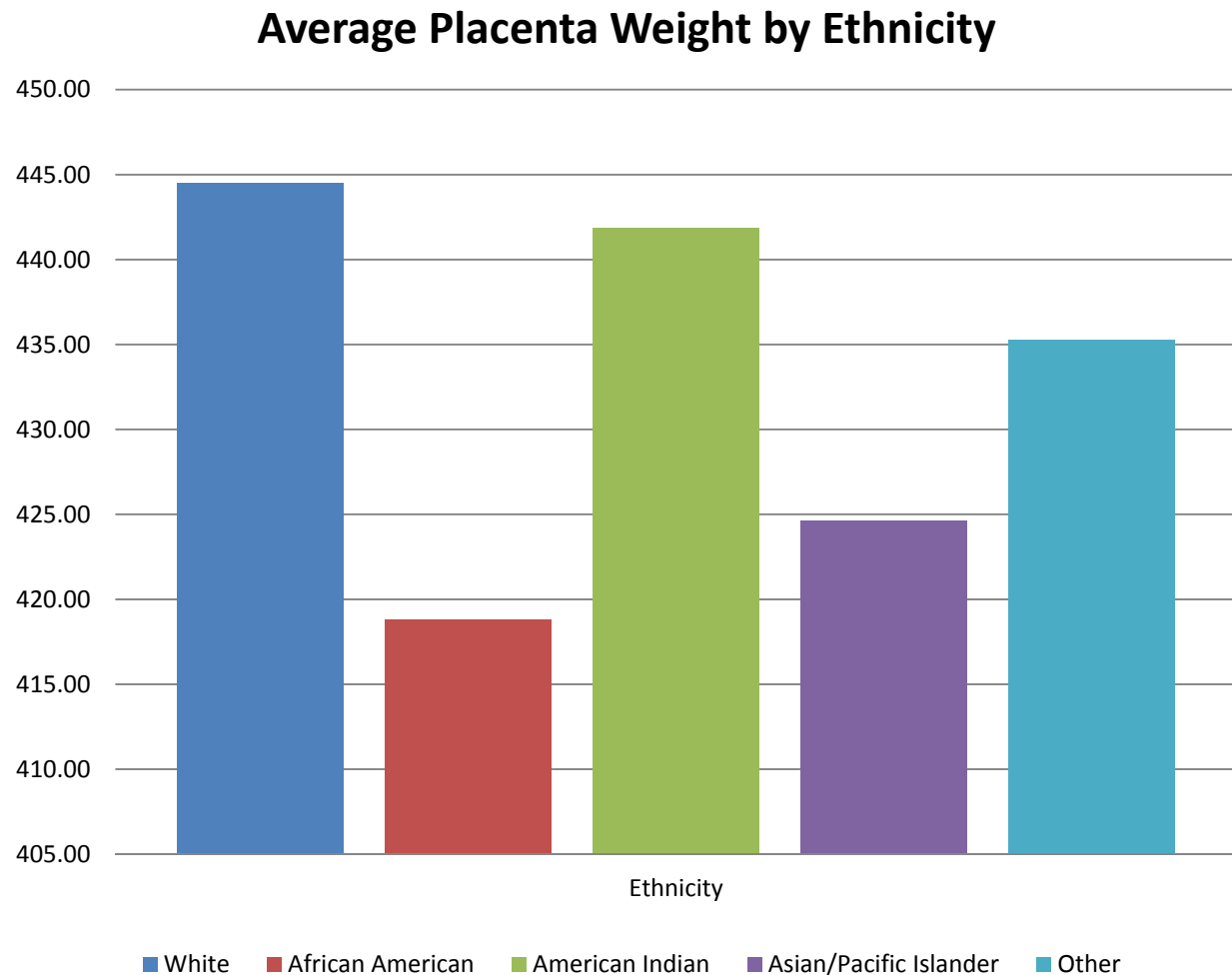
Mother's Ethnicity

- Highest placental ratio with African American mothers (.1434±.0331)

- African American babies in this study had the lowest average birth weight compared to their placenta weight

- Average placental ratio ranged from 13.3% to 14.4%

Average Placental Ratio by Ethnicity

Ethnicity

■ White ■ African American ■ American Indian ■ Asian/Pacific Islander ■ Other
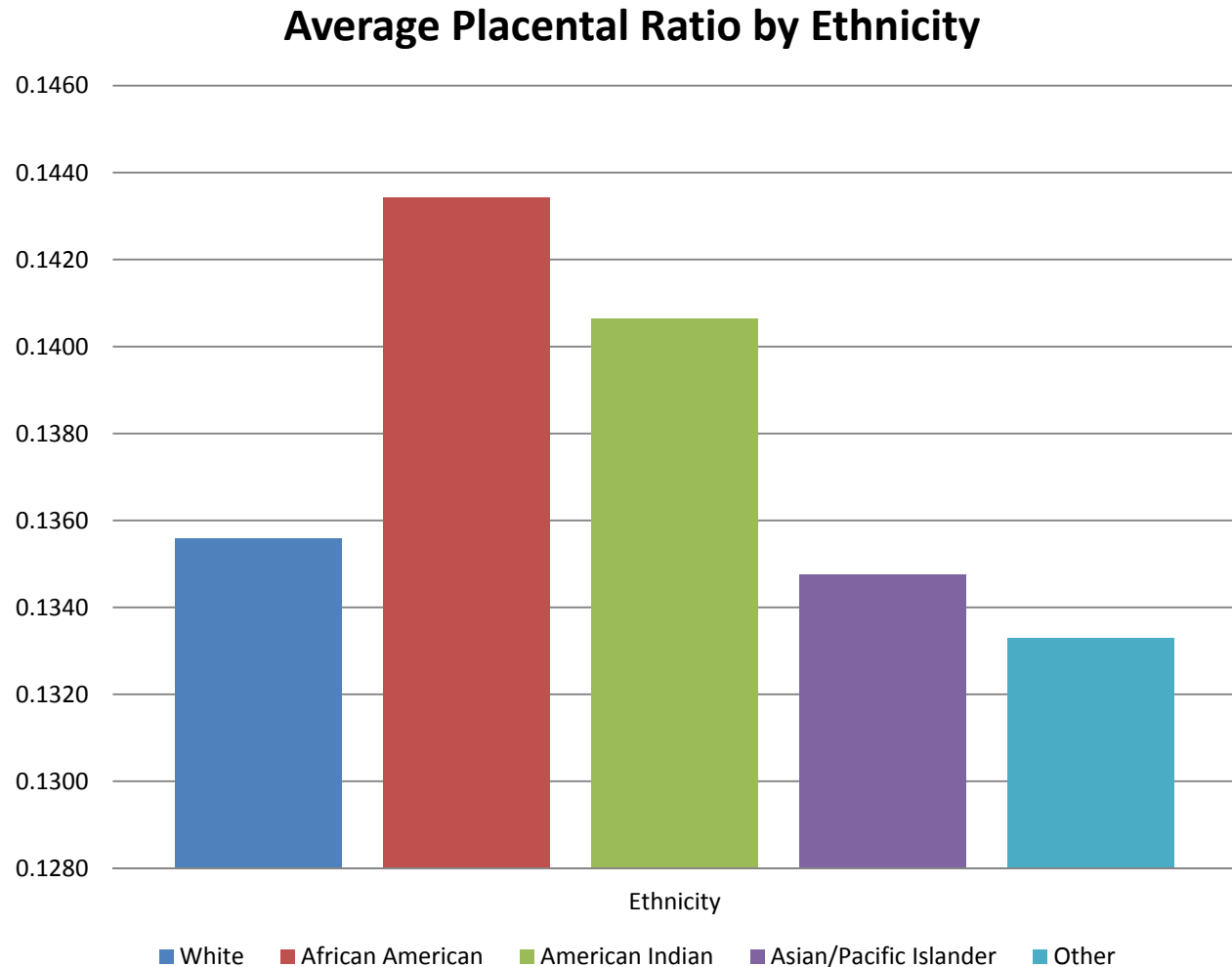
Gestational Diabetes

- Gestational diabetes is a type of diabetes that is found for the first time when a woman is pregnant. This diabetes means that the blood sugar level is too high.

- In our data we have 1182 women without gestational diabetes and 47 women with gestational diabetes.

- The mean placenta weight of the women with gestational diabetes is 460 while the mean placenta weight of the non-gestational diabetes women is 438.

Gestational Diabetes

- In the non-gestational diabetes group there are 565 women below the mean placenta weight and 617 above it.

- In the gestational diabetes group there are 28 women below the mean placenta weight and 19 above it.

Principal Component Analysis

- PCA is a procedure that uses an *orthogonal transformation* to convert a set of possibly correlated variables into a set of uncorrelated variables

- By testing different variable combinations, we wish to observe if data can be "separable", suggesting a pattern.
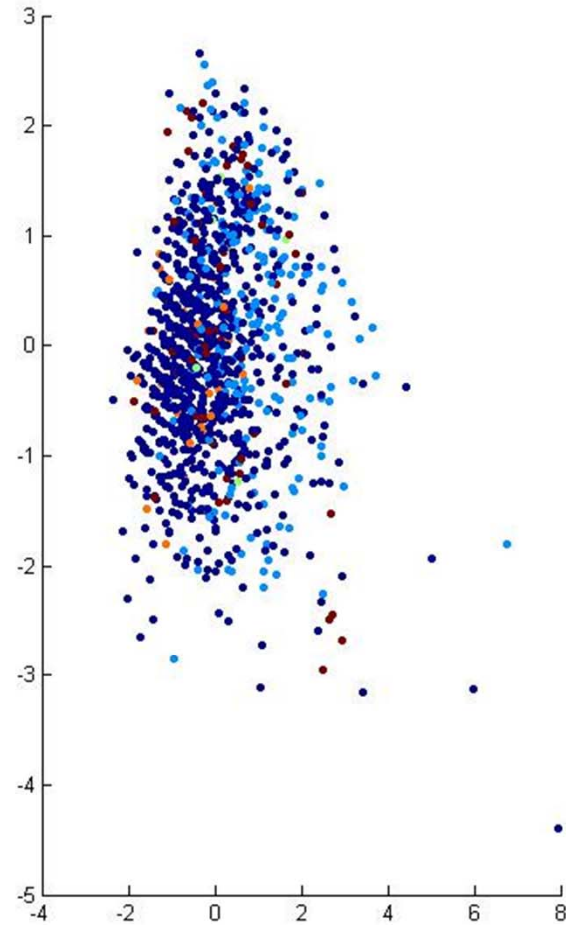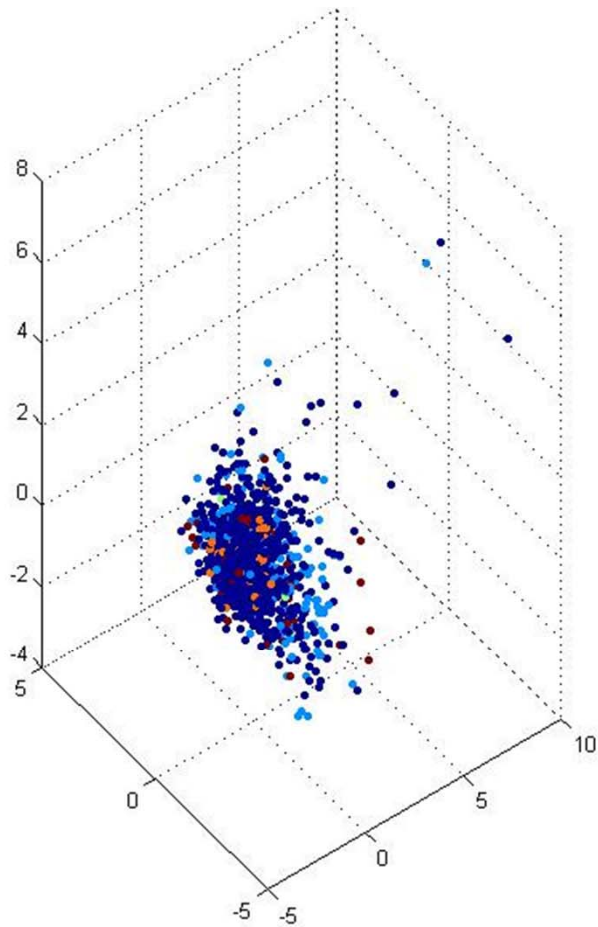
Principal Component Analysis Example

Maternal Age, Pre-Pregnancy BMI, and Placental Weight as chosen variables and color-coded by Ethnicity

Another Example

Maternal Age, Pre-Pregnancy BMI, and Placental Ratio as chosen variables and color-coded by Ethnicity

Further Research

1. Grouping and classification within the Principle Component subspace
   - K –mean method
   - Nearest Neighbor Method

2. Further Statistical Investigations
   - Logistical Regression

3. Another Direction Entirely
   - Suggestions?