A Pilot Study of Exercise, and Changes in BMI and Body Fat In High School Freshman

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<u>Background</u>

1. **Obesity in the United States has led to health problems such as:**
   - **heart disease**
   - **stroke**
   - **diabetes**
   - **certain types of cancer (such as colon cancer, endometrial cancer, and postmenopausal breast cancer)**

2. **High school freshmen encounter many new decisions about what food they eat and how much exercise they get. These decisions could be influenced by:**
   - **peer pressure**
   - **unhealthy foods readily available (cafeteria food, candy bars, soda, etc.)**
   - **health/nutrition programs and physical education classes**
   - **changing hormonal balances**

Research Question

Do students' body fat percentages and/or Body Mass Indices (BMI) change as a result of changes in diet and/or exercise?

Methods

- **Study Group:** 34 first-year freshmen high school students (19 female, 15 male, 20 white, 11 black, 1 Hispanic, 1 mixed), recruited from freshmen health classes, returned Parental Consent forms (34.3% completion rate- 34 students / 99 total students in the four health classes)

- **Study Design:** longitudinal- with the first data collection at the beginning of the semester and the second data collection near the end (105 days apart).

- **Measurements:** Weight and Body Fat Percentage (Tanita BF-682 Scale plus Body Fat Monitor)

- **Questionnaires:** Fruits/Vegetables/Fiber Intake Survey, Fat Intake Survey, Exercise Survey, Self-reported Height (Berkeley Nutrition Services)

- **Data Analysis:**
  - Variables: Average Fruits/Vegetables Servings, Average % of Diet from Fat, Average Fiber Intake (grams), Weight (calculated into Body Mass Index), Total Minutes of Exercise per Month, and Body Fat Percentage

- **Statistical Analyses:** Linear Regression and the Students' T-test
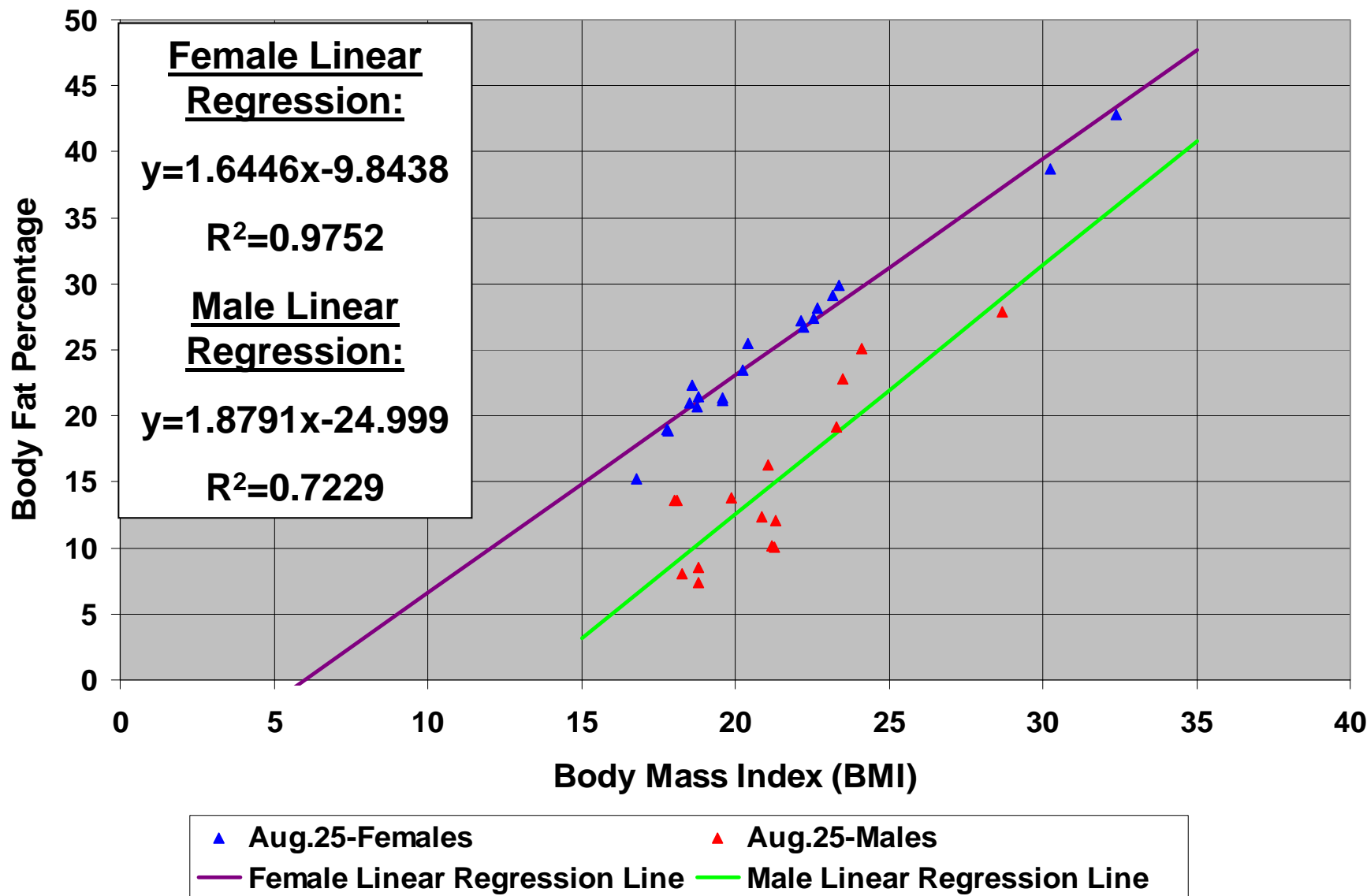
Body Mass Index: First Used in the 1800s

- Adolphe Quetelet developed the Body Mass Index formula in the 1800s.

- Non-metric Units:

$$BMI = \frac{(\text{weight in pounds}) * 703}{(\text{height in inches}^2)}$$

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http://www.famousbelgians.net/quetelet.htm

Female BMI Values Have a Stronger Correlation with their Body Fat Percentages than Male

Female Linear Regression:
y=1.6446x-9.8438
R^2=0.9752

Male Linear Regression:
y=1.8791x-24.999
R^2=0.7229

Body Fat Percentage

Body Mass Index (BMI)

▲ Aug.25-Females   ▲ Aug.25-Males
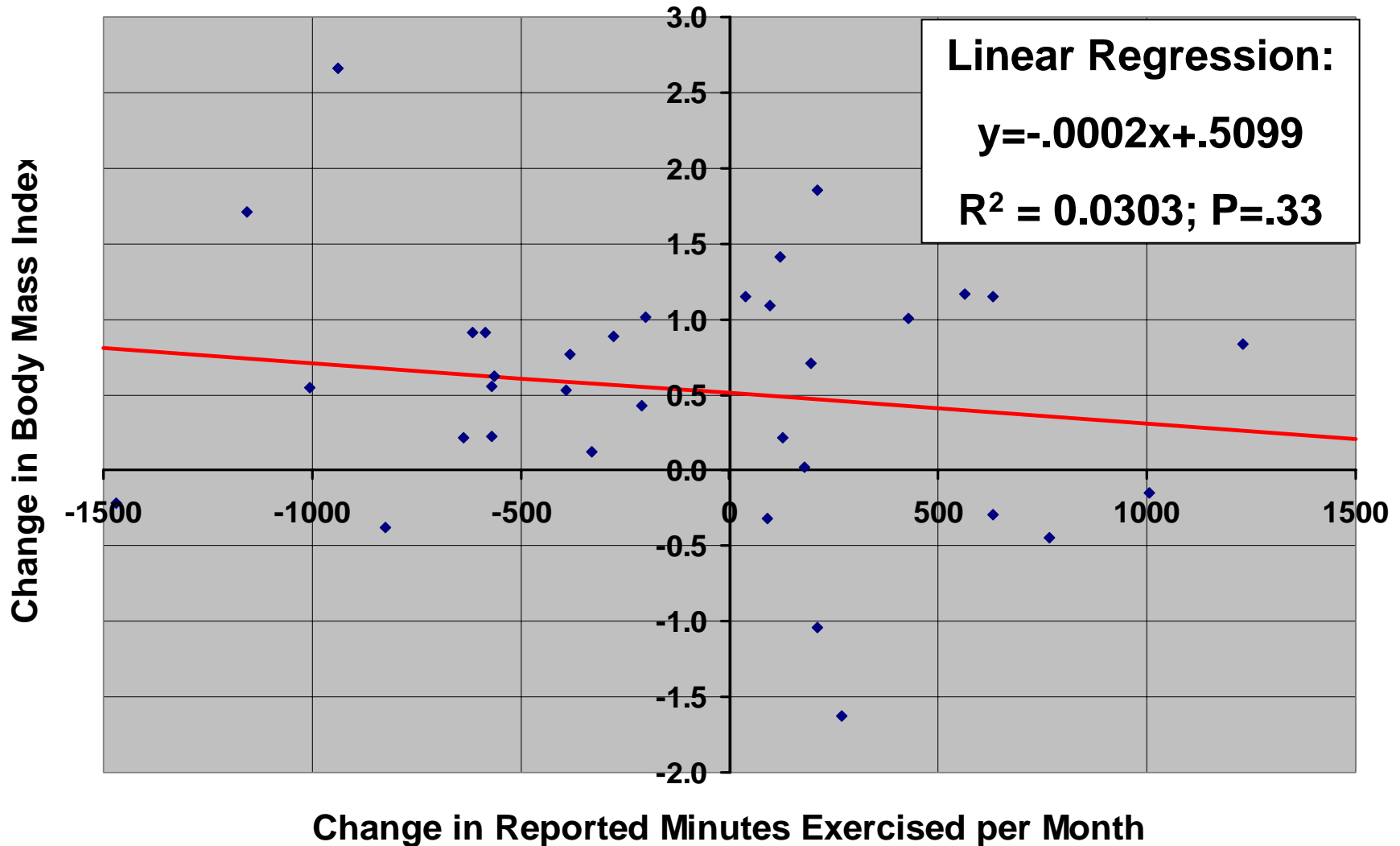— Female Linear Regression Line   — Male Linear Regression Line

Female Body Fat Percentages are Much Higher than their BMI Values

- **Black Females (n=8); Black Males (n=3); White Females (n=10); White Males (n=10); 3 participants excluded**

- **BMI values are clustered in the ~20-~25 range.**

- **BMI values may not be accurate for people who either have much higher or much lower body fat percentages than normal population.**
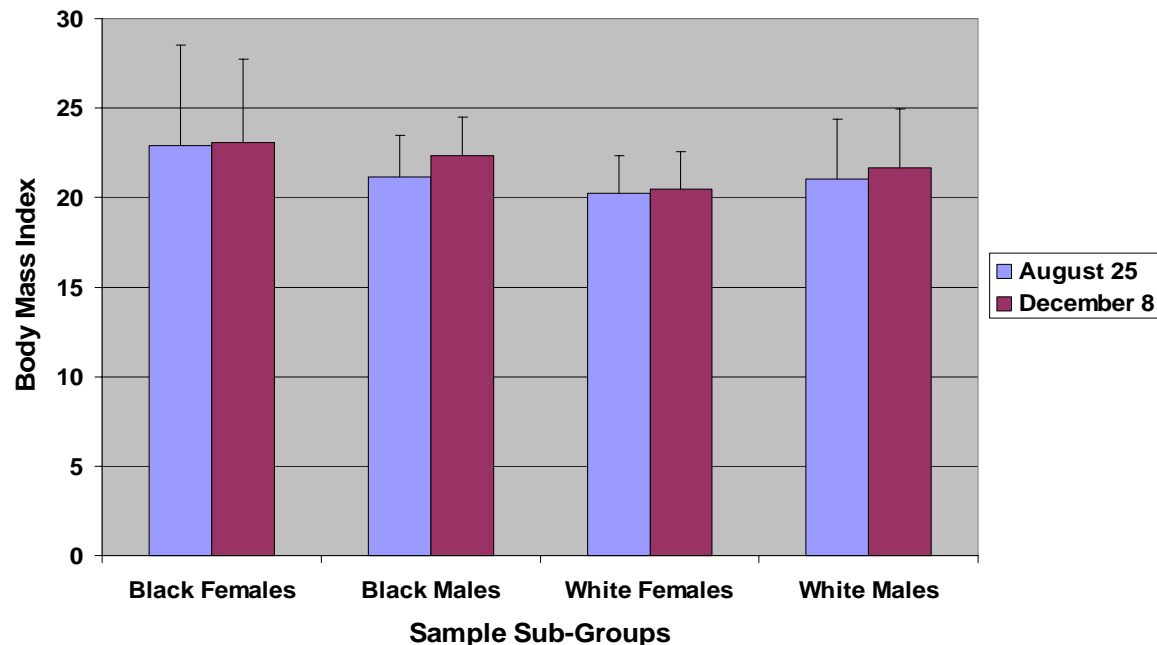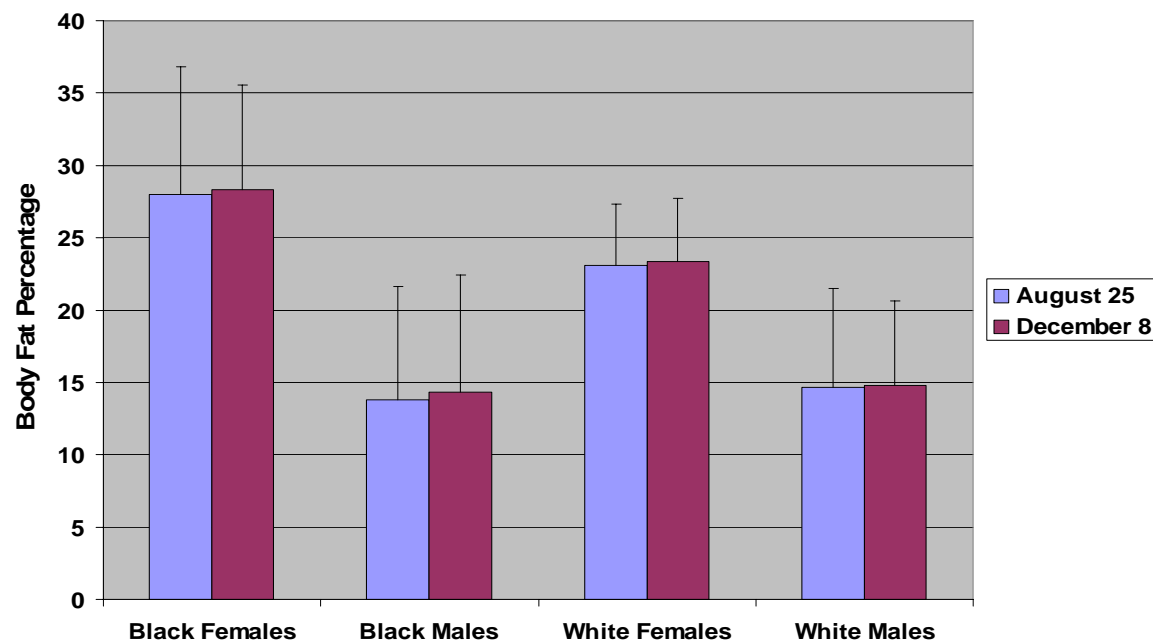
No Significant Correlation Between Increased Exercise and Decreased BMI

Change in Body Mass Index

Linear Regression:

$y=-.0002x+.5099$

$R^2 = 0.0303; P=.33$

Change in Reported Minutes Exercised per Month

◆ Change in Exercise vs. Change in BMI ▬▬ Linear Regression

Males Show a Greater Change in Body Fat than Females

- A majority of both females (68.4%) and males (73.3%) increased their body fat percentages.

- 76.9% of the females who increased their body fat only increased it by 1 percentage point or less.

- 72.7% of males who increased their body fat increased it by 1 percentage point or more.
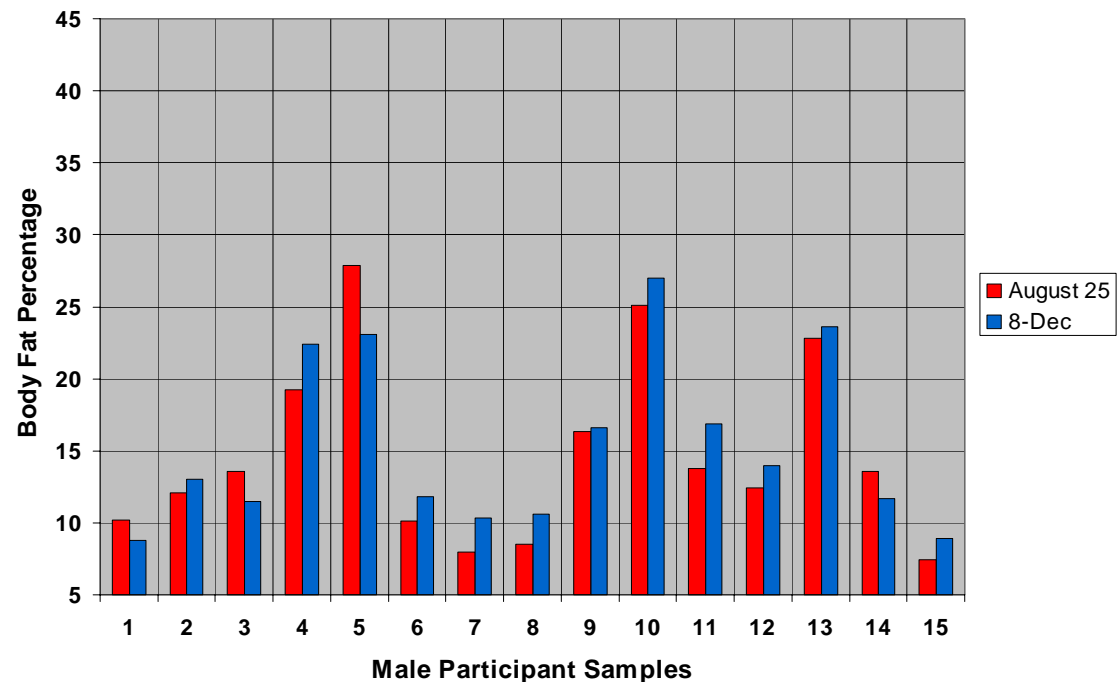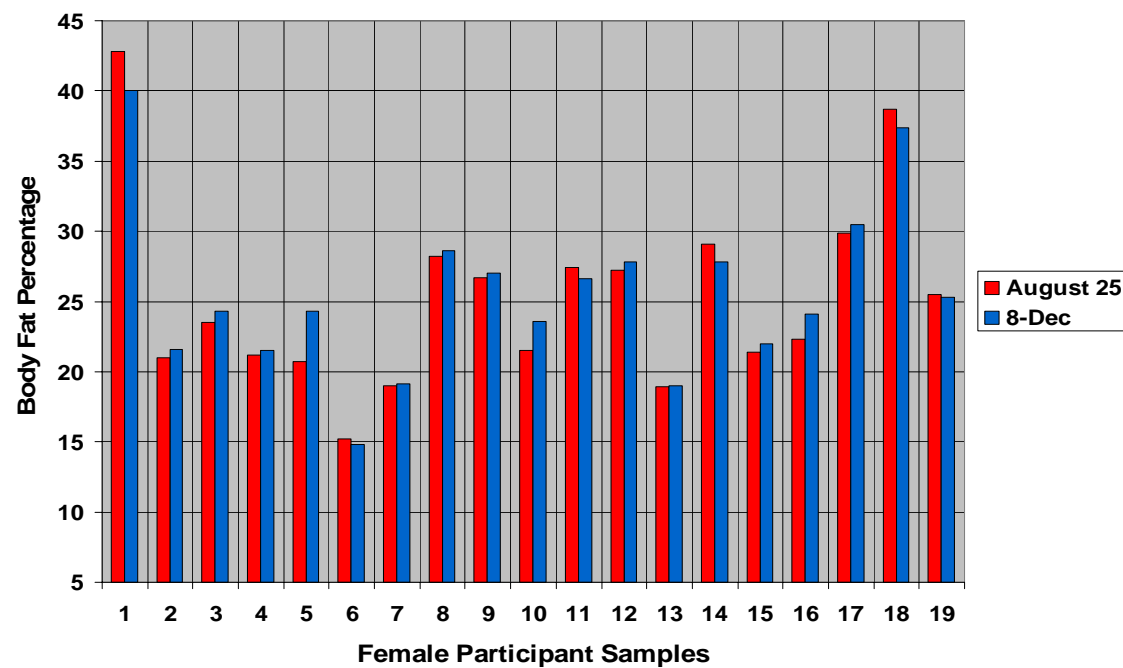
Summary

• Body Mass Index values: may not be accurate for people who either have much higher or much lower body fat percentages than normal population.
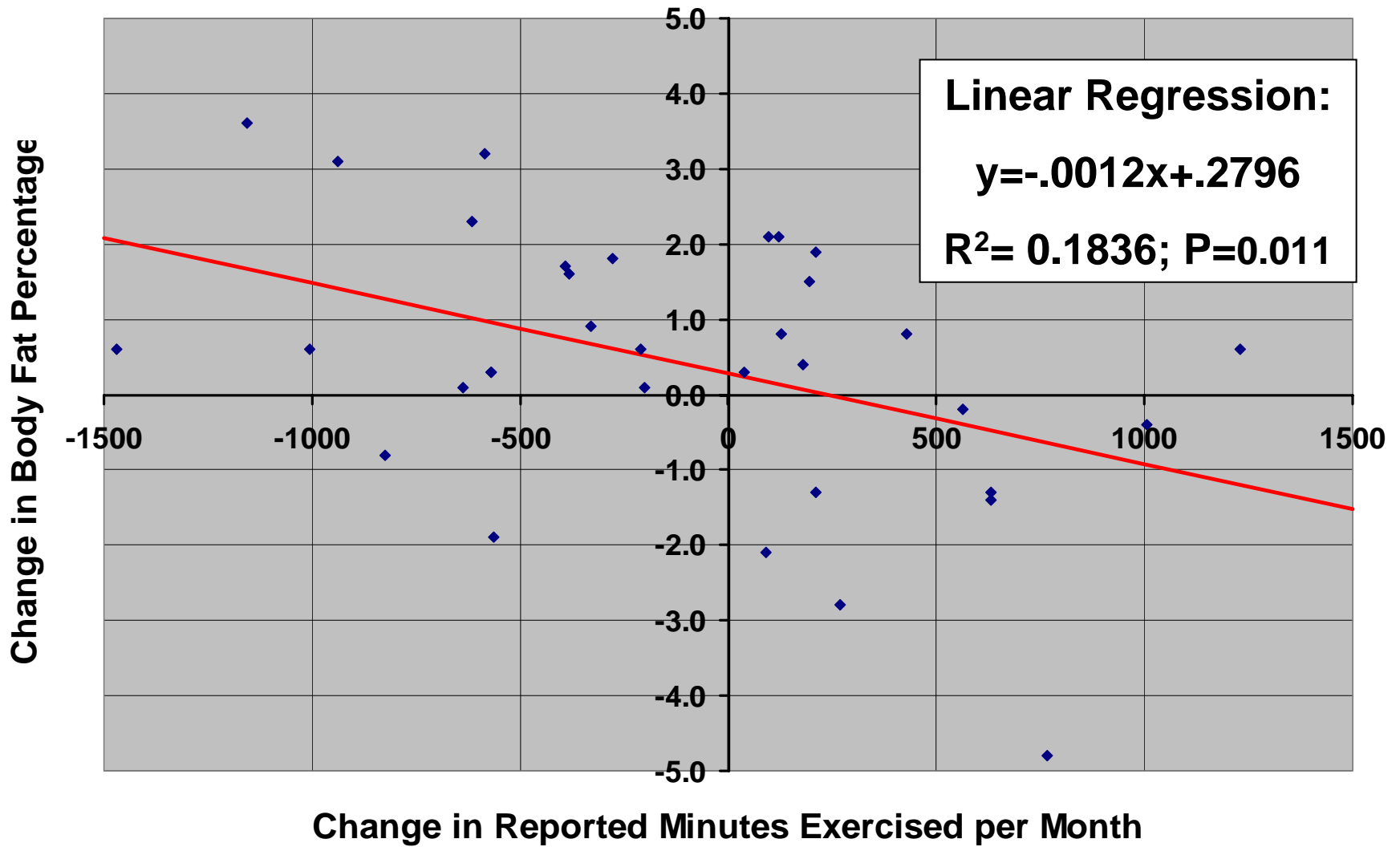
• Body Fat Percentages: may be a better tool than BMI to assess general health in high school students.

• <u>Decreasing</u> exercise leads to an increase in body fat (88.2% of participants) but increasing exercise leads to a decrease in body fat in only 47.1% of participants.

• Monitoring body fat percentages continuously in children and adolescents could help identify early indicators for obesity.

Exercise Survey

On average, over the past month, how many times have you participated in these activites for 15 or more minutes at one time?

Daily Activities

	Never	1-3 times per month	Once a week	2-4 times per week	5-6 times per week	Every day
1 Walking (normal pace)						
2 Speed walking						
3 Jogging (light pace; can hold a conversation)						
4 Jogging (medium pace; can talk but not hold a conversation comfortably)						
5 Running (hard pace; not able to talk)						
6 Recreational sports (pickup basketball, football, soccer, casual swimming, tennis; not played on an organized team)						
7 Competitive sports (basketball, football, soccer, swimming, tennis, etc; played on school, club or community (ie. parks and rec) team)						
8 Dance classes						
9 Aerobics classes						
10 Biking (either exercise bike or normal)						
11 Yoga/ Pilates						
12 Elliptical machine						
13 Stairmaster						
14 Lifting weights (leisurely, with many rest periods)						
15 Lifting weights (strenuously, with few rest periods)						

Amount

Appendix Slide 2: Sample Data from the Nutritional Intake Surveys

Table 4: Change in Average Body Fat Percentage and Average BMI in 4 Different Groups	Black Females	Black Males	White Females	White Males
Change in Average Body Fat Percentage	0.35	0.5	0.25	0.14
Change in Average BMI	0.17	1.19	0.26	0.59
Change in Average % of Diet from Fat	-5.6225	-3.33	-2	-1.75