Maddison Hajek and Ethan Janak

Lab #4- Case Study Report

Biology 106

Section #8

1. **Steps 1-4 of the scientific method:**
2. **Observation:** We noticed there seems to be more individuals exercising at the Otto Recreation Center in the evening than in the morning.
3. **Question:** Why do more individuals exercise later in the day than in the morning? Do individuals choose to exercise in the evening because they have more energy later in the day?
4. **Hypothesis:** Individuals who exercise in the evening have a higher perceived energy level before their workout than those who exercise in the morning due to higher energy availability from food consumed throughout the day. Genton, L. et al., performed an experiment that tested the effects of energy and macronutrient intakes associated with physical activity and exercise. Through analyzing various individuals with different amounts and types of food consumption and performing various forms of exercise, the scientists reached the conclusion that it is extremely important for individuals to intake carbohydrates at any time near endurance or resistance training along with protein for muscle synthesis. In the hypothesis, it is believed that individuals in the evening will have a higher perceived energy level before their workout because of higher amounts of food consumed throughout the day. Because individuals in the morning are less likely to intake as many carbohydrates and proteins than those in the evening due to an obvious time restraint, it will be more likely that individuals will have a higher perceived energy level in the evening than in the morning.
5. **Prediction:** If energy availability is higher in the evening than in the morning, then individuals who exercise at 7 p.m. will rate their perceived energy level higher than those who exercise at 8 a.m.
6. **Define your populations**
7. **Population #1:** The first population is a total of twenty randomized individuals exercising on the top floor of the Otto Recreation Center at 8 a.m. on Tuesday, February 7 and Thursday, February 9.
8. **Population #2:** The second population is a total of twenty randomized individuals exercising on the top floor of the Otto Recreation Center at 7 p.m. on Tuesday, February 7 and Thursday, February 9.
9. **Variables and units**
10. **Independent variable and units:** The independent variable for this study is the two different populations, the population at 8 a.m. and the population at 7 p.m., that individuals at the Otto Recreation Center are asked to rate their perceived energy level. This independent variable is measured in units of time.
11. **Dependent variable and units:** The dependent variable for the study is the perceived energy level that is provided to by twenty individuals exercising at 8 a.m. and twenty individuals exercising at 7 p.m. This energy level is measured on a scale from 1-5 with 1 as dragging, 3 as normal for the individual, and 5 as jumping off the walls.
12. **Constants:** The constants of this study are the location of the individuals exercising (top floor of the Otto Recreation Center) and the two days (Tuesday, February 7 and Thursday, February 9) the individuals are asked to rate their perceived energy level.
13. **Methods:**

We went to the top floor of the Otto Recreation Center on Minnesota State University Mankato’s campus at 8 a.m. and 7 p.m. on Tuesday, February 7 and Thursday, February 9. To have a random sample size of the population, we went up to ten individuals performing various exercises without any specific order or plan. The individuals were performing some form of cardiovascular activity, either walking, running, biking, or on the elliptical. Approaching one individual at a time, we asked what his or her perceived energy level was before working out on a scale from 1 through 5. We explained this energy level scale by stating that 1 was equal to dragging/extreme sluggish and 5 was equal to bouncing off the walls. When recording the data, we noted their response along with the individual’s sex and what type of exercise they were performing. This was done to have more information to draw conclusions from. After asking ten individuals in both populations on both of the days, we analyzed the data, specifically the perceived energy levels provided by the individuals, by comparing the means and 95% confidence intervals between the two populations.

**F) Results:**

Table 1. Mean and descriptive statistics of two populations of individuals exercising on two different days at the Otto Recreation Center at 8 a.m. and 7 p.m.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Population | N | Mean | Median | DF | SS | s2 | SD | SE | t95(SE) | 95% CI |
| 8 a.m. | 20 | 2.85 | 3.00 | 19 | 11.05 | 0.58 | 0.76 | 0.17 | 0.36 | 2.49-3.21 |
| 7 p.m. | 20 | 3.13 | 3.00 | 19 | 4.94 | 0.26 | 0.51 | 0.11 | 0.23 | 2.90-3.36 |

A

A

Figure 1. Mean number of energy level of individuals exercising at the Otto Recreation Center at 8 a.m. and 7 p.m. times. Error bars are ± 2.09 SE. Letters indicate there is no signficant difference between the two populations.

The results of this study show that there is no statistical difference in the mean number of energy level of individuals exercising at the Otto Recreation Center at 8 a.m. and 7 p.m. This can be analyzed through taking the significance level (t95(SE)) for each population time, which is found in Table 1, and adding or subtracting the population’s mean to determine the confidence intervals. These confidence intervals are shown in the last column of Table 1, where it can be seen that the two number intervals do indeed overlap. Analyzing Figure 1 is another method of reaching the same conclusion. The error bars for the two different time populations overlap, which indicates the mean number of energy level is not significantly different.

**G) Discussion**

As stated in the results, the data of this study showed no signficant difference in energy level of individuals exercising at 8 a.m. and 7 p.m. This refutes the hypothesis that individuals who exercise in the evening have a higher perceived energy level before their workout than those who exercise in the morning due to higher energy availability from food consumed throughout the day. There are several factors that could have influenced the results and prevented the hypothesis from being met. Individuals could have consumed coffee, energy drinks, or more food than expected in the morning that would have increased their perceived energy levels. Because it was not specifically asked if individuals had consumed any type of beverage or food before their workout, it cannot be assumed that this was the case. The personal schedules of individuals could also have played a role in when individuals chose to workout, thus disrupting the randomization of individuals asked to rate their energy level. In the study, it was observed that individuals seemed to work out more often at night, with a signficant greater number of people at the gym at 7 p.m. than at 8 a.m. Lastly, the energy scale (1-5, with 1 being dragging and 5 as jumping off the walls) could have been too constricted with not enough variance in between the two extremes. In addition, an experiment performed by Seo, D.Y, et al., tested the effects of different exercise types, times, and hormonal adaptations. It was confirmed that diurnal or hormone variations led to differences in physical performance for exercise performed in the morning and evening. However, the scientists had contracting results on aerobic exercise, with individuals performing best at both times of the day (morning and evening). Because of this, it can be inferred that deciphering when the best time to perform cardiovascular exercise is very difficult, which was the specific type of exercise analyzed in the individuals of this study. If this experiment was to continue, the methods could be altered to incorporate the amount of food and beverages individuals consumed a specific time frame before their workout to get a better grasp of how the individuals are rating their perceived energy level. Modifying the energy scale would also be important to allow more variability in perceived energy levels.

**H) Literature Cited**

Genton, L., K. Melzer, and C. Pichard. 2010. Energy and macronutrient requirements for physical fitness in exercising subjects. Clinical Nutrition 29:413-423.

Seo, D. Y., S. Lee, N. Kim, K. S. Ko, B. D. Rhee, B. J. Park, and J. Han. 2013. Morning and evening exercise. Integrative Medicine Research 2:139-144.