The memorandum should:

1. be written to be understandable by the head trainer who has minimal statistical literacy,
2. provide a clear explanation regarding the effect of consumption of white chocolate (over baseline) on the total distance covered that includes corresponding numerical summaries and *p*-value,
3. provide a clear explanation regarding the effect of consumption of dark chocolate (over baseline) on the total distance covered that includes corresponding numerical summaries and *p*-value,
4. Include a reasonable recommendation (for or against) regarding the inclusion of chocolate in the athletes’ diet (and if for inclusion, which type of chocolate) with appropriate support that references the reported 95% confidence interval for comparing dark chocolate to white chocolate.

In providing feedback, comment on the degree to which these above four criteria were achieved. What parts were written well? What parts were missing or perhaps more difficult to understand? How might an explanation or the recommendation be improved?

You have been hired by the U.S. bicycle team to help them train for the Tour de France. The head trainer recently read an article, which presents the results of a study about the effects of the consumption of chocolate (dark chocolate and white chocolate) on a number of important outcome variables during cycling. These outcome variables included: oxygen consumption (ml/kg/min), heart rate (bpm), blood lactate (BLa), blood pressure (mmHg), and an all-out bicycle sprint performance (meters).

The experimental setup consisted of a randomized crossover design where the various outcome variables of *n* = 9 male participants were measured in two trials after participants consumed either dark chocolate (40 grams of Dove) or white chocolate (40 grams of Milkybar), each for two weeks. A crossover design is a repeated measurements design such that each subject receives the two different treatments (dark chocolate versus white chocolate) during the different two-week time periods, i.e., the patients **cross over** from one treatment to another during the course of the experiment. The order of which treatment was received in the first time period was randomized. Prior to receiving the first treatment, each participant underwent baseline measurements on the outcome variables.

The trainer was specifically interested in the results for the all-out sprint performance which measured the distance traveled (in meters) for a two-minute time trial. **He would like to know how the regular consumption of chocolate affects the total distance covered during an all-out sprint and if the type of chocolate consumed matters.** Some of these results are presented in the table below. Although this sample size is small, you can consider it a reasonable one for this type of study, and can thus focus on interpreting the results.

**Distance Covered (in meters = m) during Time Trial\* Note: *n* = 9 for each condition**

|  | **Baseline** | **White Chocolate (WC)** | **Dark Chocolate (DC)** |
| --- | --- | --- | --- |
| **Mean** (m) | 1367 | 1419 | 1606 |
| **Std dev** (m) | 171 | 248 | 158 |
| ***p*-value** (compared to baseline) | - | 0.319 | 0.001 |

**Dark Chocolate:** 95% Confidence Interval for the population average change in total distance covered (dark chocolate over baseline) is 165.01 m to 312.76 m; (*p*-value 0.001).

**Dark versus White Chocolate:** 95% Confidence Interval for the population average change in total distance covered (dark chocolate over white chocolate) is 82.11 m to 291.21 m; (*p*-value = 0.003).

Data is from: Patel, R. K.; Brouner, J.; Spendiff, O. *Journal of the International Society of Sports Nutrition*. **2015** 12:47.

The trainer knows you have some statistics background and wants your help on understanding and interpreting these results. Based on the results from the article, write a memorandum to the trainer addressing the following three questions:

1. Did the total distance covered after consumption of white chocolate increase as compared to baseline, on average? If so, by how much? And was the increase statistically significant? Use the corresponding averages in the table as well as the reported *p*-value of 0.319 to explain your answer.
2. Did the total distance covered after consumption of dark chocolate increase as compared to baseline, on average? If so, by how much? And was the increase statistically significant? Use the corresponding averages in the table as well as the reported *p*-value of 0.001 to explain your answer.
3. Based on these results, in terms of increasing total distance covered, what is your recommendation (for or against) regarding the inclusion of chocolate in the athletes’ diet? And if for inclusion, which type of chocolate? Use your answers to questions 1 and 2, as well as the provided 95% confidence interval for comparing dark chocolate to white chocolate to explain your answer.

Memo

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Two Chocolates

The researchers compared the d

Based on the results of the study, while the table showcases what appears to be an average increase of 57m covered after the consumption of white chocolate when compared to the baseline in their sample. The resulting conclusion of white chocolate consumption leads to an increase in distance traveled is not true according to the researchers the increase in distance while listed is not noteworthy or statistically significant. This result is due to the listed p-value of 0.319 when compared to base line. In other words, the researchers failed to prove that consumption of white chocolate in their sample study led to a significant increase in distance coved during a sprint when compared to baseline.

1. Did the total distance covered after consumption of dark chocolate increase as compared to baseline, on average? If so, by how much? And was the increase statistically significant? Use the corresponding averages in the table as well as the reported *p*-value of 0.001 to explain your answer.

That being said the results of the dark chocolate consumption are quite the opposite. Based on the results of the study, the table showcases an average increase in distance covered of 239m after the consumption of dark chocolate when compared to baseline in their sample. This increase in distance covered is statistically significant and the researchers showcase this with the p-value of 0.001. This value led the researchers to conclude that consumption of dark chocolate in their sample study did lead to an estimated increase in distance traveled during sprints.

1. Based on these results, in terms of increasing total distance covered, what is your recommendation (for or against) regarding the inclusion of chocolate in the athletes’ diet? And if for inclusion, which type of chocolate? Use your answers to questions 1 and 2, as well as the provided 95% confidence interval for comparing dark chocolate to white chocolate to explain your answer.

The researchers further compared dark and white chocolate to see if there was a significant difference in distance traveled after consumption between the two. With a p-value of 0.003, the researchers concluded that that there was a statistically significant difference between them and that dark chocolate consumption leads to an increase of 82.11m to 291.21m in distance traveled in there sample study. While the table does showcase increases in average distance traveled for both chocolates, based on the results found in the study, both individually to base line and eachother, and the statistical values they listed. It is my recommendation to include dark chocolate and not white chocolate in the athletes’ diet.

When the two chocolates where compared it was noted that Dark Chocolate had a significant increase over the white chocolate when it came to covered after consumption. The results showcased a 82.11m to 291.21m over the white chocolate.

While the sample size is low it is usual for these types of studies.

I would recommend the inclusion of dark chocolate

To: John Miller (Head trainer for US bicycle team)

From: Fake Name

Date: January 6, 2025

Subject: Chocolate Consumption on Athletic Performance

Hello John, I know we are doing everything we can to win this years Tour de France and every little bit helps. I You recently sent over an article related to if consumption of chocolate specifically white or dark chocolate would lead to an increase in performance of our athletes in distance covered during the two-minute time trial. I have taken the time to go over the study and my results are as followed.

Based on the results of the study, while the table showcases what appears to be an average increase of 57m covered after the consumption of white chocolate when compared to the baseline in their sample. The resulting conclusion of white chocolate consumption leads to an increase in distance traveled is not true according to the researchers the increase in distance while listed is not noteworthy or statistically significant. This result is due to the listed p-value of 0.319 when compared to base line. In other words, the researchers failed to prove that consumption of white chocolate in their sample study led to a significant increase in distance coved during a sprint when compared to baseline.

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