

K - Memo on how consuming white and dark chocolate can affect distance traveled (in meters) for a two-minute time trial

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PROMPT

Enter the text from your memorandum into the text box provided. If desired, you can use text formatting to increase the readability of your memorandum.

To: Head Trainer, U.S. bicycle team

Title: Memo on how consuming white and dark chocolate can affect distance traveled (in meters) for a two-minute time trial

This memo aims to inform you on:

1. What a crossover study is and its benefits
2. Results of the experiment
3. Recommendation for or against your athletes consuming chocolates, and which types of chocolates

1. What a crossover study is and its benefits

A randomised crossover study involves assigning participants at random to undergo 2 separate trials.

-Trial 1 involves participants consuming white chocolate (40 grams of Milkybar) for the first two weeks, before consuming dark chocolate (40 grams of Dove) for the next two weeks.

-Trial 2 involves participants consuming dark chocolate (40 grams of Dove) for the first two weeks, before consuming white chocolate (40 grams of Milkybar) for the next two weeks

Therefore during a crossover study, the patients cross over from one trial/treatment to another.

(Source: <https://www.coursera.org/learn/inferential-statistical-analysis-python/supplement/ij9TF/chocolate-cycling-assignment-instructions>)

From a randomised crossover study, there are **three benefits**:

1. We can double the number of results we get by two - 9 measurements for the effect of consuming white chocolate, and 9 measures for the effect of consuming dark chocolate, **while keeping to a small sample size of 9 participants**. Therefore a crossover study is **more efficient** than traditional experiments which could assign 9 participants to dark chocolates and 9 participants to white chocolates, for a total of 18 participants.
2. From point #1, a crossover study could be **less expensive to run** as "participant acquisition" costs would be lower than a traditional study, even over the same study duration
3. The **order** of whether a participant takes white chocolate or black chocolate first is **randomised**. This helps to **control for alternative explanations** when effects may occur due to a particular fixed order (such as only having white chocolate first).

And from a crossover study, the **disadvantage** is that it is possible that **there could exist carryover effects** (whether positive or negative effects) from either:

- From the first stage of having white chocolate first to dark chocolate later, or
- From the first stage of having dark chocolate first to white chocolate later.

For the purpose of our study, let us assume there were no carryover effects.

(Source: Krauth, J. (2000). *[Techniques in the Behavioral and Neural Sciences] Experimental Design - A Handbook and Dictionary for Medical and Behavioral Research Volume 14 || Designs which Had better be Avoided.* , (), 92–108. doi:10.1016/s0921-0709(00)80007-3)

2. Results of the experiment

From an experiment conducted by Patel, Brouner and Spendiff on a simple random sample of 9 athletes,

- a. the estimated mean baseline distance (meters) was 1367m, with possible values within a 95% confidence interval ranging from 1196m to 1538m

b. after athletes took **white chocolate** for 2 weeks, the estimated mean distance (meters) was 1419, with possible values within a 95% confidence interval ranging from 1171m and 1667m, and the result was **not significant enough** for us to claim that athletes who consume white chocolate would perform better than athletes who do not consume any chocolate

c. after athletes took **black chocolate** for 2 weeks, the estimated mean distance (meters) was 1606, with possible values within a 95% confidence interval ranging from 1448m and 1764m, and the result was **significant enough** for us to claim that athletes who consume dark chocolate seem to perform better

d. to support point (c), after athletes took black chocolate for 2 weeks, the **mean difference in distance when athletes consumed dark chocolates and when athletes did not consume any chocolate was 239.5m**, with possible values within a 95% confidence interval ranging from 164m and 315m, and the result was **significant enough to claim that on average, athletes who consume dark chocolate would perform better than athletes who do not consume any chocolate, by between 164m to 315m in the two-minute time trial**

e. the **mean difference in distance when athletes consumed dark chocolates and when athletes consumed white chocolates was 187m**, with possible values within a 95% confidence interval ranging from 82m and 292m, and the result was **significant enough to claim that on average, athletes who consume dark chocolate would perform better than athletes who consume white chocolate, by between 82m to 292m in the two-minute time trial**

(Source: Patel, R. K.; Brouner, J.; Spendiff, O. Journal of the International Society of Sports Nutrition. 2015 12:47.)

3. Recommendation for or against your athletes consuming chocolates, and which types of chocolates

From the results presented in part 2, there is **strong evidence for including chocolates, in particular dark chocolates (40 grams of Dove)**, in the daily diet plan of the athletes under your charge.

However as the study where the results were obtained came from including dark chocolates in an athletes diet for a short period of two weeks, **more tests need to be performed to determine the**

- impact on your athletes' performance if you include dark chocolates in their diet over a longer period of time
- impact on your athletes' performance if they choose to take more or less dark chocolates per day
- impact on your athletes' performance if they choose to avoid dark chocolates for one or more days

RUBRIC

This memorandum should be written to be understandable to the trainer who has basic statistical literacy.

Comment on the degree to which this was achieved.

1. What parts were written well?
2. What parts would be more difficult to understand?

Word count: Minimum 30 words



Ujjal Kumar Mahapatro

well



jean-luc thirion

The memo is well written. Sections related to the different questions are clearly delimited. It could have been benefited to be a bit shorter.



Yibo Tang

This memo is well-written regarding its structure and readability. No parts are difficult to understand.

The study design should be described in this memo. Comment on how the submission addresses cross-over design.

1. What is described well?
2. What is missing? How might the description be improved?

Word count: Minimum 30 words



Ujjal Kumar Mahapatro

well



jean-luc thirion

Crossover is explained in great details. Good job! I feel this section was a bit too long for a memo format: - Some points may not be relevant for the trainer like the fact that the study was less expensive to run. He does not pay the already made study ;) - The 2 main points for the trainer are the small sample size (which is well addressed), the fact that each participant acts as its own control: meaning that difference in individuals in both groups cannot explain for differences in results. Same advantage as a "Paired Data" studies.



Yibo Tang

The study design is described very well with additional references included. Great job!

Comment on how the submission addresses the small sample size, what p-values indicate about the results, and the meaning of statistical significance.

1. What is explained well?
2. What is missing? How might the explanation be improved?

Word count: Minimum 30 words



Ujjal Kumar Mahapatro

well



jean-luc thirion

Small sample size very well addressed



Yibo Tang

The small sample size is addressed within the introduction of crossover design. However, there is no content related to p-values and statistical significance in this memo.

Comment on how the submission provides an **interpretation** of both confidence intervals, and an explanation of the meaning of the confidence level in context.

1. What is interpreted well?
2. What is missing? How might the description be improved?

Word count: Minimum 30 words



Ujjal Kumar Mahapatro

well



jean-luc thirion

The signifiante is clear for the coach. A good for taking a decision based on study. Maybe a description of what 95% means would have helped (It does NOT mean that the true mean has a 95% chance to be in the provided interval, and I guess the course creators wanted you to rehash that)



Yibo Tang

Great interpretation. Informative and clear!

Comment on the **recommendation** provided for or against inclusion of chocolate (and if inclusion, which type of chocolate) in the athletes' diet.

1. What is described well?
2. What is missing? How might the description be improved?

Word count: Minimum 30 words



Ujjal Kumar Mahapatro

well



jean-luc thirion

Well addressed point. It is good that you tried to tamper with the 2 weeks period. As we all know DC is not the miracle cure for top level cyclists... We all feel it is unrealistic. In particular note how the sample is not representative of USA national team members (sample of 9 not so well trained cyclist - look their VO2 values) . Also improvements noted in the article are huge, and if cyclist that is already at the top could achieve such improvements he would win each time...



Yibo Tang

This part is also well-written. Suggestions are given for further validating the results/tendency obtained in this study.

Thinking about your written assessment of the five components of the learners' memorandum, please provide an overall grade for the assignment that is consistent with your carefully written observations.



10 points

The memorandum fully addressed all aspects of the grading rubric, including:

- **being understandable to a stakeholder with basic statistical literacy**
- **a clear description of study design**
- **a discussion of sample size**
- **an interpretation of confidence intervals**
- **recommendation for or against inclusion of chocolate in diet**

UM

JT

YT



8 points

The memorandum mostly addressed aspects of the grading rubric, with only a few areas needing improvement.



6 points

The memorandum partially addressed aspects of the grading rubric, with several areas needing improvement.



1 point

The memorandum did not address the aspects of the grading rubric, with nearly all components missing or needing significant improvement.