TO: The Head Trainer, U.S Bicycle Team

DATE: December 3, 2023

SUBJECT: Effects of the Consumption of Chocolate on Cycling

INTRODUCTION: This Memorandum presents the interpretation and understanding of the result of a cycling experiment. The cycling experiment consist of a randomized "crossover design" where the various outcome of nine (9) male participants was measured in two trials after participants consumed either dark chocolate or white chocolate. The results presented are shown below (Note: all measurements are in meters)

PRESENTED RESULT

	Baseline	White Chocolate (WC)	Dark Chocolate
Mean (m)	1367	1419	1606
Std dev (m)	171	248	158
p-value (compared to baseline)		.319	.001

DARK CHOCOLATE: 95% Confidence interval for the population average change in total distance covered (dark chocolate over baseline) is 165m to 314m; (p-value=0.001)

DARK CHOCOLATE VS WHITE CHOCOLATE: 95% Confidence interval for the population average change in total distance covered (dark chocolate over white chocolate) is 82m to 292m ;(p-value=0.003) (R. K.; Brouner, J.; Spendiff, O. **2015** 12:47)

OBJECTIVE: To validate the significant effect of chocolate (Dark Chocolate and White Chocolate) on cycling

METHODOLOGY: The interpretation of this result is base on statistical inference of the population parameter. The statistical significant level of 0.05 is used in the findings. We set a null hypothesis that the two compared average values are equal (i.e. no difference) and an alternate hypothesis that the average values are unequal, we either choose to reject or accept the null hypothesis base on our evaluation

INTERPRETATION/FINDINGS

DARK CHOCOLATE VS BASELINE: From the result presented, the average difference in distance for the population parameter at 95% confidence interval is between 165m and 314m. Since this interval does not contain a negative value or zero (0), we can be 95% confident that there is a positive difference in average performance when a cyclist consumes dark chocolate, compared to the baseline. The p-value of

0.001 mean we should reject the null hypothesis and accept the alternative hypothesis, as this value is less than 0.05 which is the critical p-value for 95% confident interval.

WHITE CHOCOLATE VS BASELINE: From the result presented, the p-value in this case is 0.319. This p-value supports the null hypothesis, so we accept it. If we construct the interval for the average change in population at 95% confidence interval we get that an average difference of zero (0) is in-between this interval. Further experiment is needed to validate this claim.

DARK CHOCOLATE VS WHITE CHOCOLATE: From the result presented, the average difference in distance for the population parameter at 95% confidence interval is between is 82m to 292m. Since this interval does not contain a negative value or zero (0), we can be 95% confident that there is a positive difference in average performance when a cyclist consumes dark chocolate, compared to white chocolate. The p-value of .003 mean we should accept the alternative hypothesis, as this value is less than 0.05.

DISCUSSION/CONCLUSION

It is important to note that the cross design experiment is beneficiary as it allows us to compare different setup of the experiment **on the same sample** in order to check for changes. If the setup is not on the same sample, individual skills might be the cause of changes. We should also consider the assumption for which the statistical calculation was made. It is necessary to understand that this 95% confident level we have on our statistical procedure (assuming they are done right). All the hypothesis accepted should also undergo further experiment to assert claims.

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