Choclocate & Cycling Assignment

October 5, 2024

Inferential Statistical Analysis with Python Course

University of Michigan

0.0.1 Background

Distance Covered (in meters) during Time Trial

	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

95% Confidence Intervals

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 vs 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)

$ $**N o t e**: n = 9 for each condition

0.0.2 Statistical Analysis

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?

The difference between the two population means is approximately 52 meters. At a significance level of $\alpha = 0.05$, and given our p-value of 0.319, we cannot conclude that there is a significant difference between them. In other words, we fail to reject the null hypothesis ($H_0 : \mu_1 - \mu_2 = 0$), since $0.319 > 0.05$. The observed difference could be due to random variation rather than a true effect.

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?

The difference between the two population means is about 239 meters. The 95% confidence interval includes this value,

$$CI_{95\%} = (165.01, 312.76)$$

Considering a significance level of 0.05, the p-value of 0.001 allows us to reject the null hypothesis ($H_0 : \mu_1 - \mu_2 = 0$). This indicates that the difference is statistically significant, suggesting that the consumption of dark chocolate has a effect on the distance covered by cyclists.

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?

Based on the analysis, we recommend including dark chocolate in cyclists' diets. This suggestion is based by the comparison between the baseline mean and the dark chocolate mean. Further, by analyzing the confidence interval between the dark and white chocolate means,

$$CI_{95\%} = (82.11, 291.21),$$

we observe that the difference of 187 meters falls within the interval range. Thus, considering an α level of 0.05, and with a p-value of 0.003 ($0.003 < 0.05$), we reject the null hypothesis. Therefore, we can say that there is a significant difference between the means of the two chocolate samples.

0.0.3 Recommendation

The results suggest that eating **dark chocolate** can help cyclists cover more distance. When we compared cyclists who ate dark chocolate to those who didn't, the difference in performance was **statistically significant**. This means the improvement we saw is not likely due to random chance but rather a real effect of the dark chocolate. Based on these findings, **we recommend cyclists include dark chocolate in their diets to improve their performance**.

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