# The Effects of a Pre-Workout Supplement on Anaerobic Performance

Alyssa Labrosse and Jessica Luder

## Introduction

- Multi-ingredient pre-workout supplements have gained popularity amongst athletes and fitness enthusiasts of all ages.
- These supplements advertise performance enhancing benefits such as increases in anaerobic and aerobic performance, strength, focus and more (Shoshan & Post, 2021).

## Purpose

- Are multi-ingredient pre-workout supplements worth the cost?
- The objective of this study was to determine the effects of "C4: Original Pre-Workout Powder" on anaerobic performance.
- Focusing on anaerobic power and capacity, blood lactate, fatigue index, heart rate, and mean and peak Watts.

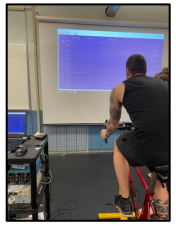
## Methods

- The Wingate test was performed twice by each participant on two separate occasions.
- One condition was performed after consumption of the placebo "ZAZ Fruit Punch Liquid Water Enhancer", and the other was performed after consumption of "C4: Original Pre-Workout Powder".
- Heart rate and blood lactate levels were monitored throughout the procedure.

**Figure 1**
*Participant Preparing for Wingate*

**Figure 2**
*Preparation Image of C4 Supplement and Placebo*


**Figure 3**
*Preparation Performing Wingate*



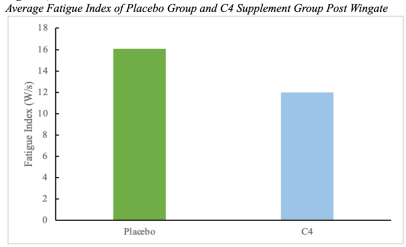
## Results

**Table 1**
*Data Averages of C4 Supplement Compared to Placebo*

| Variable | Placebo Average | C4 Average | Difference | p-value |
|---|---|---|---|---|
| Fatigue Index (W/s) | 16.09 | 11.99 | -4.10 | 0.18 |
| Post Blood Lactate (mmol/L) | 12.10 | 11.78 | -0.32 | 0.88 |
| Anaerobic Capacity (W/kg) | 6.99 | 7.92 | 0.93 | 0.35 |
| Anaerobic Power (W/kg) | 9.81 | 10.14 | 0.33 | 0.68 |
| Resting Heart Rate (bpm) | 75 | 72 | -2.89 | 0.48 |
| Post Test Heart Rate (bpm) | 158 | 163 | 4.78 | 0.67 |
| Mean Watts | 571.67 | 491.33 | -80.33 | 0.21 |
| Peak Watts | 819.89 | 671.11 | -148.78 | 0.20 |

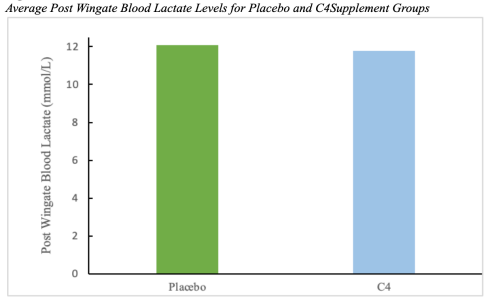
*Note.* Placebo averages and C4 supplement averages are listed as well as the differences between them. The significance (p-value) from the ANOVAS is listed in the last column.

**Figure 4**
*Average Fatigue Index of Placebo Group and C4 Supplement Group Post Wingate*



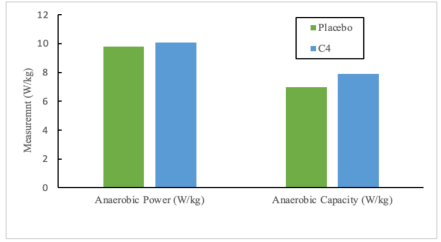

*Note.* Fatigue index for the placebo group's results can be seen on the left in green with an average fatigue index of 16.09W/s, while the C4 supplement group's results can be seen on the right in blue with an average fatigue index of 11.99W/s.

**Figure 5**
*Average Post Wingate Blood Lactate Levels for Placebo and C4Supplement Groups*



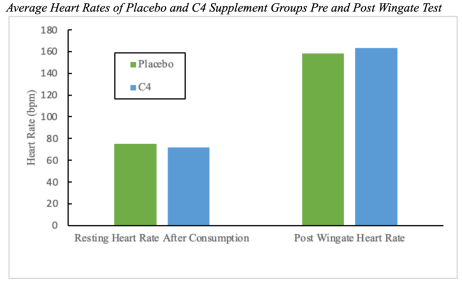

*Note.* Average post-Wingate blood lactate levels can be seen with the placebo group having an average of 12.10mmol/L, while the C4 pre-workout supplement had an average post-Wingate blood lactate of 11.78mmol/L.

**Figure 6**
*Average Anaerobic Power and Capacity for Placebo and C4 Supplement Groups*



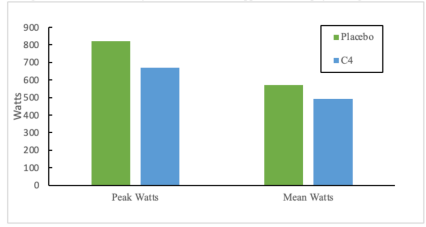

*Note.* Average anaerobic power is on the left with the placebo group represented in green, and the C4 supplement represented in blue. Anaerobic capacity is on the right, again with the placebo group in green, and the C4 supplement in blue. The average anaerobic power for the placebo group was 9.81W/kg, while the C4 supplement group was 10.14W/kg. The average anaerobic capacity for the placebo group was 6.99W/kg while the C4 supplement group was 7.92W/kg.

**Figure 7**
*Average Heart Rates of Placebo and C4 Supplement Groups Pre and Post Wingate Test*




*Note.* Average resting heart rate and average post Wingate heart rate is represented above for both the placebo and the C4 supplement group. Average resting for the placebo group was 75bpm while the average for the C4 supplement group was 72bpm. Average post heart rate for the placebo group was 158bpm while the C4 supplement group's average was 163bpm.

**Figure 8**
*Average Peak and Mean Watts for Placebo and C4 Supplement Groups for Wingate Test*




*Note.* Average peak and mean Watts are represented for both the placebo and C4 supplement groups. For peak Watts, the placebo group had an average of 819.89 Watts while the C4 supplement group had an average of 671.11 Watts. For mean Watts, the placebo group had an average of 571.67 Watts while the C4 supplement group had an average of 491.33 Watts.

## Discussion

- The findings of this study show that C4 had a positive impact on fatigue index, blood lactate levels and anaerobic power and capacity, however none of the results were statistically significant.
- Some evidence suggests that the acute effect of caffeine in small doses is effective at increasing peak and mean power during the Wingate test (Lara et al., 2021). In figure 8, the results show this was not the case in this study.
- There is also evidence that the caffeine content in pre-workout supplements can cause an increase in heart rate (Benjamim et al., 2021). In figure 7, average resting heart rate was lower for the C4 condition compared to the placebo, however, the C4 condition had a higher post Wingate heart rate.

## Conclusion

- The results from this study showed that the C4 pre workout supplement had no statistically significant influences on anaerobic performance, however, small improvements were observed.
- There could be other potential physical and psychological benefits that pre workout supplements pose to individuals consuming it.
- Limitations include a small sample size made up of active college students and this study only observed short duration, high intensity exercise.
- Future research should be warranted to observe the influence that pre workout has on different exercise types as well as on different populations.

## References

Benjamim, C. J. R., Monteiro, L. R. L., Pontes, Y. M. de M., Silva, A. A. M. da, Souza, T. K. M. de, Valenti, V. E., Garner, D. M., & Cavalcante, T. C. F. (2021). Caffeine slows heart rate autonomic recovery following strength exercise in healthy subjects. *Revista Portuguesa de Cardiologia (English Edition)*, *40*(6), 399–406. https://doi.org/10.1016/j.repce.2020.07.021

Lara, B., Salinero, J. J., Giráldez-Costas, V., & Del Coso, J. (2021). Similar ergogenic effect of caffeine on anaerobic performance in men and women athletes. *European Journal of Nutrition, 60*(7), 4107–4114. https://doi.org/10.1007/s00394-021-02510-6

Shoshan T., & Post, E. (2021). Prevalence of Protein and Pre-Workout Supplement Use among High School Football Players and Potential Product Contamination. *Global Pediatric Health, 8*. https://doi.org/10.1177/2333794X211031202