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EXTENDED  
ABSTRACT

# Acute Effects of Dark Chocolate on Perceived Exertion and Short-Distance Running Performance in Active Young Adults

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## I. INTRODUCTION

Dark chocolate (DC) is rich in flavanols, theobromine, and caffeine compounds known to improve vascular function, alertness, and fatigue resistance. While existing research highlights chronic benefits for endurance performance, there is limited evidence on its acute effects in anaerobic contexts like sprinting. Most prior studies also emphasize female or endurance-trained populations. This study investigates whether a single 40g dose of dark chocolate ( $\geq 70\%$  cocoa) influences perceived exertion and 400-meter sprint performance in active young adults. A randomized, controlled, crossover design was used to assess its short-term ergogenic potential in non-elite, physically active males.

## II. METHODS

This study utilized a randomized, controlled, crossover design to examine the acute effects of dark chocolate on perceived exertion and sprint performance. 20 physically active young male participants aged 18 to 25 were recruited based on strict inclusion criteria, ensuring they were free from cardiovascular, metabolic, or neurological disorders and had no allergies to cocoa or lactose. Participants were randomly assigned to begin with either the intervention (dark chocolate) or the control condition. The intervention consisted of consuming 30–40g of dark chocolate containing at least 70% cocoa, exactly one hour before a maximal 400-meter sprint. All participants adhered to a 10-hour pre-trial fast and avoided caffeine, dark chocolate, and nitrate-rich foods for 24 hours prior.

Performance was measured using a digital stopwatch on a standard athletics track. Immediately after the sprint, participants rated their exertion using the Borg 1–10 Rating of Perceived Exertion (RPE) scale. After a 7-day washout period, participants switched conditions and repeated the protocol to control for order effects.

## III. RESULTS AND DISCUSSION

Table I presents descriptive statistics for perceived exertion (RPE) under dark chocolate and control conditions among active young adult males. The analysis indicates that the standard deviation is smaller in the dark chocolate group ( $SD = 0.852$  vs.  $1.100$ ), and the Mean RPE is lower with dark chocolate ( $6.10$ ) than with control ( $6.50$ ), indicating reduced perceived effort. Participants had more consistent perceptions of exertion when supplemented with dark chocolate.

Next, the descriptive statistics for Short-Distance Running Performance under dark chocolate and control conditions among active young adult males. The analysis indicates the standard deviations were similar ( $SD = 12.56 - 12.61$ ) and Mean time after dark chocolate ingestion ( $M = 84.74s$ ) compared to control ( $M = 86.66s$ ). Participants completed the 400-meter sprint faster after dark chocolate ingestion compared to the control.

TABLE I  
DESCRIPTIVE TABLE FOR PERCEIVED EXERTION (RPE) AND SHORT-DISTANCE RUNNING PERFORMANCE BETWEEN DARK CHOCOLATE VS CONTROL (NON-SUPPLEMENTED)

	N	MEAN	MEDIAN	SD	SE
RPE_DC	20	6.10	6.00	0.852	0.191
RPE_CONTROL	20	6.50	6.00	1.100	0.246
TIME_DC (S)	20	84.74	85.63	12.559	2.808
TIME_CONTROL (S)	20	86.66	87.63	12.607	2.819

Based on Table 2, the results revealed a statistically significant reduction in Rating of Perceived Exertion (RPE) following dark chocolate ingestion compared to the control condition. Participants reported a mean RPE of 6.10 after consuming dark chocolate, versus 6.50 in the non-supplemented trial, with a mean difference of  $-0.40$   $t(19) = -2.99$ ,  $p = 0.008$ . These compounds are known to inhibit adenosine receptors, which may reduce mental fatigue and enhance arousal. Furthermore, participants completed the trials during nighttime hours, a time when external distractions and heat stress were minimized, factors that may also influence perceived exertion. Additionally, participants were already engaged in regular physical activity such as futsal, jogging, and fitness training, which may have enhanced their capacity to interpret physical effort more efficiently.

Next, running performance statistical analysis showed a highly significant improvement in 400-meter sprint performance under the dark chocolate condition compared to the control. The mean completion time was 84.74 seconds after dark chocolate ingestion, compared to 86.66 seconds in

the control group, with a mean difference of -1.914 seconds ( $t(19) = -12.04, p < 0.001$ ). This performance enhancement can be attributed to several physiological mechanisms. Catecholamine modulation, particularly increased epinephrine and norepinephrine activity, may heighten sympathetic arousal, reaction time, and motor unit recruitment. These effects support anaerobic performance and delay the onset of muscular fatigue. Additionally, improved cerebral oxygenation may enhance pacing, focus, and motor coordination throughout the sprint.

TABLE II  
DIFFERENCE BETWEEN PERCEIVED EXERTION (RPE) AND SHORT-DISTANCE RUNNING PERFORMANCE BETWEEN DARK CHOCOLATE VS CONTROL (NON-SUPPLEMENTED)

VARIABLES	MEAN (SD)	T	DF	P
RPE_DC	6.10 (0.852)	-2.99	19	0.008
RPE_CONTROL	6.50 (1.100)			
TIME_DC	84.74 (12.559)	-12.04	19	<0.001
TIME_CONTROL	86.66 (12.607)			

#### IV. CONCLUSIONS

This study demonstrated that acute ingestion of dark chocolate significantly reduced perceived exertion and enhanced 400-meter sprint performance in active young males. The observed improvements are likely due to the synergistic effects of cocoa flavanols, caffeine, and theobromine, which promote vasodilation, reduce central fatigue, and enhance mental focus. These results suggest that dark chocolate may serve as a practical, natural ergogenic aid for short-duration, high-intensity exercise. Given its accessibility, safety, and palatability, dark chocolate presents a promising alternative to synthetic supplements for recreational athletes seeking performance and recovery enhancements.

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#### REFERENCES

- [1] Allgrove, J. E., & Spendiff, O. (2020). The influence of different concentrations of flavanol chocolate bars on physiological parameters during steady-state and incremental exercise. *European Journal of Applied Physiology*, *120*(9), 2000–2010.
- [2] Benedetti, L., Nigro, F., Malaguti, M., Di Michele, R., & Angeloni, C. (2025). Acute Effects of Dark Chocolate on Physical Performance in Young Elite Soccer Players: A Pilot Study. *Applied Sciences*, *15*(965). <https://doi.org/10.3390/app15020965>.
- [3] Callister, R., Davison, G., Williamson, G., Cooper, K. A., & Gleeson, M. (2012). The effect of acute pre-exercise dark chocolate consumption on plasma antioxidant status, oxidative stress and immunoendocrine responses to prolonged exercise. *European Journal of Nutrition*, *51*, 69–79.
- [4] Davison, G., Callister, R., Williamson, G., Cooper, K. A., & Gleeson, M. (2012). The effect of acute pre-exercise dark chocolate consumption on plasma antioxidant status, oxidative stress and immunoendocrine responses to prolonged exercise. *European Journal of Nutrition*, *51*(1), 69–79. <https://doi.org/10.1007/s00394-011-0193-4>.
- [5] Patel, R. K., Brouner, J., Allgrove, J. E., & Spendiff, O. (2020). The influence of different concentrations of flavanol chocolate bars under acute supplement conditions on exercise and performance. *European Journal of Applied Physiology*, *120*(7), 2075–2082. <https://doi.org/10.1007/s00421-020-04389-3>.
- [6] Patel, R. K., Brouner, J., & Spendiff, O. (2015). Dark chocolate supplementation reduces the oxygen cost of moderate intensity cycling. *Journal of the International Society of Sports Nutrition*, *12*, Article 47. <https://doi.org/10.1186/s12970-015-0106-7>.
- [7] Safari, K., Hemmatinifar, M., Suzuki, K., Koushkie Jahromi, M., & Imanian, B. (2025). Dark chocolate mitigates premenstrual performance impairments and muscle soreness in female CrossFit® athletes: Evidence from a menstrual-phase-specific trial. *Nutrients*, *17*, 1374. <https://doi.org/10.3390/nu17081374>.
- [8] Soares, D. D., et al. (2017). Acute cocoa flavanols intake has minimal effects on exercise-induced oxidative stress and nitric oxide production in healthy cyclists: a randomized controlled trial. *Journal of the International Society of Sports Nutrition*, *14*, Article 18.
- [9] Stellingwerff, T., Godin, J.-P., Chou, C. J., Grathwohl, D., Ross, A. B., Cooper, K. A., Williamson, G., & Actis-Goretta, L. (2014). The effect of acute dark chocolate consumption on carbohydrate metabolism and performance during rest and exercise. *Applied Physiology, Nutrition, and Metabolism*, *39*(2), 173–182. <https://doi.org/10.1139/apnm-2013-0152>.
- [10] Vordos, Z., Deli, I., Anifanti, M., Kluzek, S., Koutlianos, N., Kouidi, E., & Deligiannis, A. (2024). The effect of dark chocolate consumption on arterial function in endurance male runners: Prospective cohort study. *Sports*, *12*, 344. <https://doi.org/10.3390/sports12120344>.