Effects of Exercise on Glycemic Response after Consumption of Monster Energy

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Introduction

Insulin sensitivity is a physiological function required for glucose uptake into cells. When glucose enters the bloodstream, the body responds to the glucose challenge by secreting insulin, an endocrine hormone produced by beta cells in pancreatic islets. Insulin binds to insulin receptors on cell membranes, activating 2° messengers to induce glucose transporter protein movement to the plasma membrane, increasing glucose permeability into the cell. During exercise, insulin sensitivity is increased to cause faster glucose uptake to replenish ATP concentrations in insulin sensitive tissues, such as skeletal muscle.

Energy drinks are frequently consumed by young adults to increase energy levels and alertness (Malinauskas, et al, 2007). Energy drinks contain glucose and other ingredients such as caffeine and taurine that may produce physiological effects. Energy drinks may enhance physical and mental performance and may increase pain tolerance (Alford, et al, 2001 and Ragsdale, et al, 2009). How exercise affects physiological responses caused by energy drink consumption, such as insulin sensitivity and glycemic response, is unclear.

The purpose of this study was to examine the effects of standardized aerobic exercise on glycemic and cardiovascular response, immediately before the ingestion of a Monster Energy® drink.

Methods

This study was approved by the Winona State University Human Subjects Committee. Subjects consisted of 35 self-described health persons (30 female, 5 male), 19.1±1.4 years of age, 72.4±13.8 kilograms, and 176.5±10.7 centimeters. Subjects voluntarily fasted for nine hours prior to the experiment. Volunteers received one of two treatment combinations: exercising on a stationary Monarch Bike at 33% of their predicted VO_2 max for ten-minutes, with a five-minute sitting rest after, and then drinking the Monster Energy drink (experimental group), or sitting for a period of five-minutes prior to ingestion of the Monster Energy drink (control group).

After blood glucose measurement (baseline) subjects consumed a weight adjusted Monster Energy drink, which was consumed only once at the beginning of the study (0-minutes). Monster Energy drink serving size was weight adjusted: (Weight lb)*(240mL/168 lb), with 0-minutes representing the time when the subject finished their drink. Participants measured blood glucose, heart rate, and mean arterial pressure (MAP) at 0-, 30-, 60-, and 90-minutes. Data is represented as LSM ± SE with significance analyzed using a t-test, or multiple comparison test. Significance is assumed when $p < 0.05$.

Figure 1. Blood Glucose for control and experimental groups for 0-, 30-, 60-, and 90-minutes.

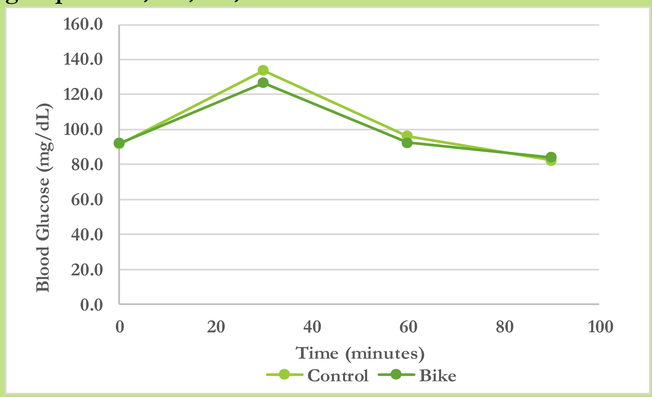


Figure 2. Heart rate for control and experimental groups for 0-, 30-, 60-, and 90-minutes.

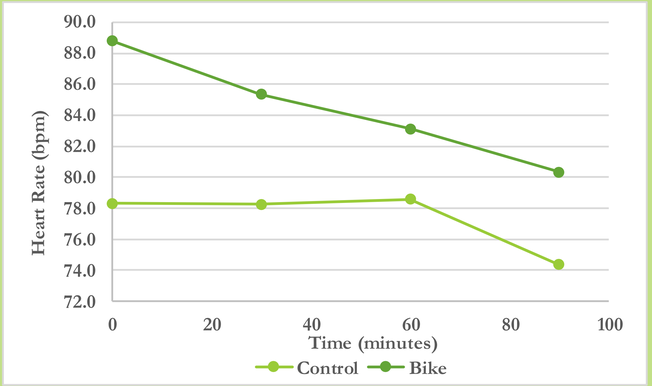
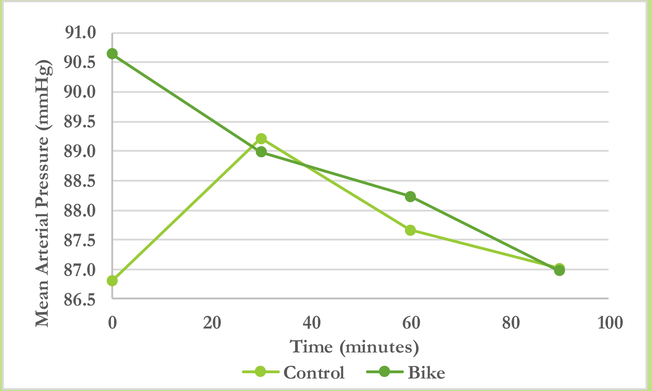


Figure 3. Mean arterial pressure for control and experimental groups for 0-, 30-, 60-, and 90-minutes.



Results

Blood glucose for control at 0-, 30-, 60-, and 90-minutes was 91.58±1.2, 133.7±4.29, 96.3±4.17, and 82.4±1.82 mg/dL, respectively. For those receiving bike exercise prior to ingestion of Monster Energy, blood glucose was 92.2±1.2, 126.6±3.79, 92.5±2.27, 84.0±1.77 mg/dL. There were no significant blood glucose differences between groups across time at 0-minutes just prior to the ingestion of Monster Energy, although 0- to 30-minutes shows significance in both groups.

Heart rate for control at 0-, 30-, 60-, and 90-minutes was 78.0±3.06, 78.2±2.55, 78.6±2.6, and 74.4±1.85 bpm respectively. For those receiving bike exercise prior to ingestion, heart rate was 88.7±3.71, 85.5±2.69, 83.1±2.35, and 80.3±2.89 bpm. No significant difference was observed between groups across time. While time 0-minutes was greater for the exercise group, this difference was not statistically significant.

Mean arterial pressure (MAP) for control at 0-, 30-, 60-, and 90-minutes was 86.8±2.05, 89.2±2.05, 89.2±2.5, and 87.6±2.6 mmHg. For those receiving bike exercise prior to ingestion, blood pressure was 90.6±3.07, 88.98±2.3, 88.2±1.97, and 86.98±2.08 mmHg. There were no significant mean arterial pressure differences observed between the groups across time.

Nutrition Facts

Serving Size 8.0 fl. oz. (240mL)
Servings Per Container 2

Amount Per Serving	Per 8 fl. oz.	%DV*	Per Can	%DV*
Calories	110		210	
Total Fat	0g	0%	0g	0%
Sodium	180mg	8%	370mg	15%
Total Carb	27g	9%	54g	18%
Sugars	27g		54g	
Protein	0g		0g	
Riboflavin (Vit. B2)	100%		200%	
Niacin (Vit. B3)	100%		200%	
Vitamin B6	100%		200%	
Vitamin B12	100%		200%	

Not a significant source of calories from fat, saturated fat, trans fat, cholesterol, dietary fiber, vitamin A, vitamin C, calcium and iron.

*Percent Daily Values are based on a 2,000 calorie diet.

Ingredients: Carbonated water, Sugar, Glucose, Citric acid, Natural flavors, Taurine, Sodium Citrate, Color added, Panax ginseng extract, L-Carnitine L-Tartrate, Caffeine, Sorbic acid (preservative), Benzoic acid (preservative), Niacinamide (Vit. B3), Sucralose, Salt, D-Glucuronolactone, Inositol, Guarana extract, Pyridoxine hydrochloride (Vit. B6), Riboflavin (Vit. B2), Maltodextrin, Cyanocobalamin (Vit. B12).

Table 1. Effects on blood glucose, heart rate, and mean arterial pressure before and after consumption of Monster Energy, (LSM±SE). * Significance 0-30 minutes and no significant differences between treatments.

Parameter	Treatment	Time 0 Minutes	Time 30 Minutes	Time 60 Minutes	Time 90 Minutes
Blood Glucose (mg/dL)	Control	91.588±1.198	133.706±4.298 *	96.294±4.175	82.353±1.828
	Bike	92.222±1.194	126.611±3.793 *	92.500±2.271	84.000±1.767
Heart Rate (bpm)	Control	78.313±3.064	78.235±2.554	78.588±2.636	74.353±1.847
	Bike	88.778±3.711	85.333±2.697	83.111±2.354	80.333±2.888
Mean Arterial Pressure (mmHg)	Control	86.804±2.051	89.216±2.520	87.667±2.572	87.020±2.073
	Bike	90.647±3.071	88.981±2.297	88.235±1.976	86.981±2.082

Discussion

- Exercise should lead to an increased skeletal muscle insulin sensitivity and glucose uptake. Insulin sensitivity was not affected in this study.
- Heart rate for the biking individuals was higher than those who did not, but it was not statistically significant.
- Mean Arterial Pressure (MAP) did not show any statistically significant data for this study.

Conclusion

Monster Energy ingestion does not have an overall effect on blood glucose, heart rate, or mean arterial pressure. Future experiments may wish to evaluate the baselines of blood glucose, heart rate and mean arterial pressure with the absence of the Monster Energy. Further research that would better explain these results would be the determination of cortisol levels in both groups. Monster Energy does not appear to have any effects on blood glucose, heart rate, or mean arterial pressure.

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References

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