Performance Drink®, a Glucose Polymer Drink, for Prolonging Exercise

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Hypothesis

The purpose of this study was to determine if the unique formulation of Performance Drink® provides a ready supply of glucose during prolonged exercise, without triggering the insulin surge commonly observed with ingestion of carbohydrate drinks . We also were looking to determine if Performance Drink® alters the changes in cognitive function often seen during long-duration exercise.

Background

Glucose availability is a major limiting factor of prolonged exercise performance. Because muscle glycogen is an important source of glucose during long-term exercise, strategies to enhance performance such as increasing glycogen in the muscle through the manipulation of diet (glycogen super compensation) or reducing the rate of glycogen utilization through increased use of either lipids or blood glucose are used. The latter strategy provides alternative fuels to the muscle to reduce dependency on muscle glycogen. The link between muscle glycogen depletion and exhaustion is well documented. It follows that increasing the availability of blood glucose will preserve muscle glycogen and exhaustion or fatigue will be delayed or diminished. A problem associated with a rapid glucose intake though, is the phenomenon of “rebound hypoglycemia” wherein initially high levels of glucose in the blood stimulate insulin release, which promotes glucose storage, rather than glucose release. Performance Drink® is a carbohydrate drink formulated to be ingested prior to exercise in order to preserve blood glucose during long-term exercise. We propose the unique formulation of the Performance Drink® drink provides a ready supply of glucose, but does not trigger the insulin surge commonly observed with ingestion of carbohydrate drinks. Recent research has also suggested brain use of glucose is crucial for optimal cognitive functioning during exercise. Maintenance of cognitive function is important to enable the individual to act and react in accordance with the specific demands of the activity. However, impaired cognition has been observed in many long-term exhaustive exercise studies and may be related to decreased glucose availability. In addition, to its role in preserving blood glucose levels for energy production in skeletal muscle, Performance Drink® may also reduce cognitive impairment.

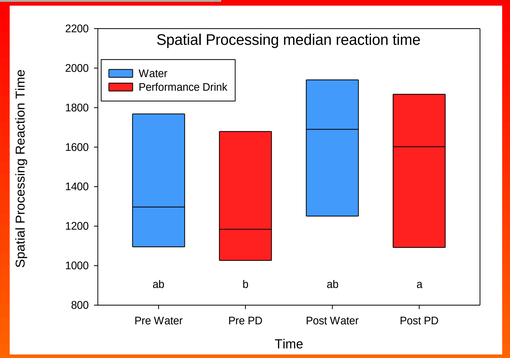
Methods

In session one, subjects fasted for 12 hours without alcohol or caffeine and no strenuous activity within the last 24 hours. Each underwent a computerized VO_2 peak cycling test using a standard procedure of increasing workload. The cycling protocol determined the level of exercise needed to exercise at 70% of VO_2peak and subjects were required to achieve a VO2 max of at least 55 ml/kg/min for males and 50 ml/kg/min for females. During sessions two through four, subjects reported at the same time of day after a three hour fast and with no extensive exercise the last 24 hours. Prior to exercise, each subject performed cognitive function tests, ANAM, This test was used to assess the speed and efficiency of information processing.

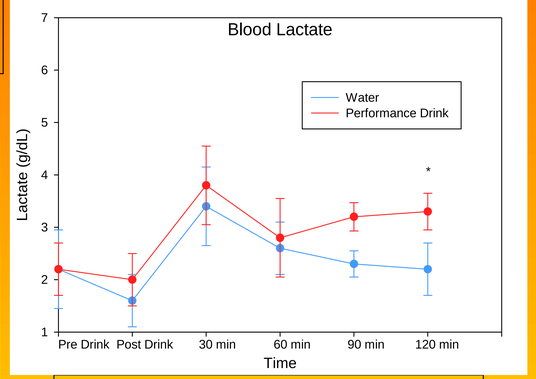
The subject rested for 30 minutes after the first blood sample (pre drink), then drank 500 mL of a predetermined solution at 25°C which will be either water with flavoring or Performance Drink® (gender specific formulation). Thirty minutes later another blood sample was drawn and the subjects started cycling at a speed/resistance (workload) that required 70% of their specific, predetermined VO_2peak for 120 minutes. Expired air was collected continuously during the endurance cycling to determine VO_2 and VCO_2. Heart rate, core body temperature, and ratings of perceived exertion were recorded at the same times as the blood draws. Blood samples and minute sampling were collected at 30, 60, 90, and 120 minutes of cycling. Each subject provided a urine sample, before and after ingesting the Performance Drink® to test for traces of performance-enhancing substances.

Cognitive function was measured immediately after the exhaustive exercise, using the ANAM test. Immediately after the ANAM and again 48 hours later, subjects were asked to complete a GI distress questionnaire. Plasma and serum were collected by centrifugation at 3000 rpm for 30 minutes at 4°C. Aliquots of 1ml were stored at -80°C for further analysis.

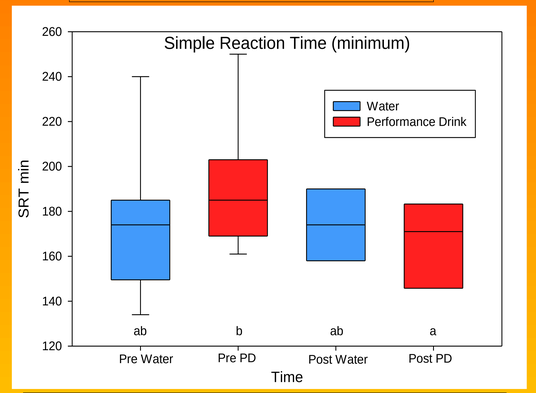
* Represents the time points where Glucose was significantly higher than Pre Drink (p < .0001)



The boxplot represents how the median time for Spatial Processing was different at post drink for water compared to PD. (p=.03)



The graph shows that the lactate level peaked during the first 30 minute cycling period. PD was significantly higher at 120 min than pre Drink.



The boxplot represents how simple reaction significantly decreased for PD. (p=.04)

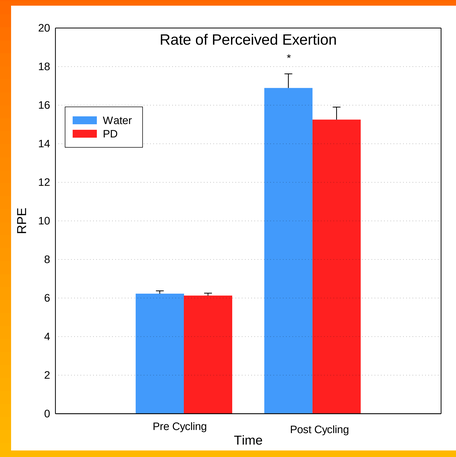
Measurements	Mean ± SD
Age (years)	26 ± 7
Height (cm)	167.2 ± 9.2
Weight (kg)	70.2 ± 11.6
Heart Rate (bpm)	59 ± 7
Body Fat (%)	13.9 ± 7
Total Cholesterol (mg/dL)	149 ± 31
HDL Cholesterol (mg/dL)	45 ± 12
Fasting Blood Glucose (mg/dL)	83 ± 8

Results

The energy output (calculated by finding the product of minutes multiplied by watts) for the water and PD were 17598 and 20402. Blood glucose averages for water and PD at 120 minutes were 81.2 mg/dL, and 88.1 mg/dL. Mean lactate levels at the end of the test for water and PD were 2.3 mmol/L and 3.41mmol/L. Mean body temperatures were 100.5 ºF and 100.6 ºF for water and PD. Average RPE upon completion of exercise for PD was 15.3 and 16.9 for water. Post exercise, simple reaction time lengthened with water and median reaction time for spatial processing decreased with water compared to PD.

Discussion

Based on previous studies of Performance Drink® we expected our results to show an increase in the subjects ability to maintain performance throughout prolonged exercise. Our results showed there was a statistically significant (p=.0001) difference in glucose availability at the end of exercise compared to 30 min post for Performance Drink®. There was a significant increase in blood lactate level for the Performance Drink at the end of exercise. Average RPE upon completion of exercise for Performance Drink was significantly lower than water. Cognitive function tests for reaction time and spatial processing improved after exercise with Performance Drink.



* Represents significant difference in PD from pre cycling to post cycling and from Water