The Effectiveness of a Pre-Exercise Performance Drink (PRX) on Indices of Maximal Cardiorespiratory Fitness

Allyn Byars[1], Mike Greenwood[2], Lori Greenwood[2], & Warren K. Simpson[3]

Department of Physical Therapy, Angelo State University, San Angelo, TX[1]; Exercise & Sport Nutrition Lab, Baylor University, Waco, TX[2], Department of Fitness and Sport Studies, Hardin-Simmons University, Abilene, TX[3]. Address Correspondence to *Allyn.Byars@angelo.edu*

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ABSTRACT

This study examined the effectiveness of a pre-exercise drink (PRX) called EM·PACT on indices of maximal cardiorespiratory fitness. Twenty-four males (n=12) and females (n=12) ages 18-24 years (20.25 + 1.42), volunteered as subjects. Each subject performed two randomized trials of a VO_{2max} treadmill test within a week of each other. Subjects in this randomized, placebo controlled, counter balanced, crossover design, ingested either a placebo (water) or PRX 20 minutes before each exercise bout. VO_{2max} and time to exhaustion (Time) during graded exercise testing were evaluated. Using paired samples t-tests, significantly greater mean values were found in VO_{2max} and Time for the PRX trial compared to the placebo trial ($p<.05$). Results indicate that indices of cardiorespiratory fitness; specifically VO_{2max} and Time are enhanced by ingestion of PRX prior to exercise testing. The combined results of this investigation may provide meaningful practical applications for coaches and athletes alike regarding ergogenic hydration options. ***Journal of the International Society of Sports Nutrition*. 3(1):56-59, 2006**

Key Words: sports nutrition, ergogenic aids, VO_{2max}, aerobic performance, sport drink

INTRODUCTION

The human body's maximal ability to use or consume oxygen for aerobic metabolism during exercise, better known as VO_2max, is an important predictor of athletic performance in endurance activities [1]. In addition, ventilatory threshold or the nonlinear increase in ventilation that coincides with the beginning of glycolysis (anaerobic threshold) for energy and the onset of blood lactate is considered by many exercise physiologists to be even a better indication of an endurance athlete's capacity for aerobic power [2]. This is particularly true when examining the metabolic demands of middle distance runners and other similar athletes in their respective sports. Either way, the ability of an individual to reduce or tolerate more lactate production or the metabolic end product caused by the excessive metabolism of carbohydrates (CHO) is an important factor in the performance of endurance athletes as well as other sports that rely heavily upon aerobic metabolic pathways [3].

Previously, research has demonstrated that CHO ingestion during aerobic exercise can improve performance during exercise sessions lasting longer that 90 minutes performed at intensities greater than 70% VO_{2max} by preventing a decline in blood glucose concentration and facilitating glucose oxidation late, whereas the timing and type of CHO ingestion following exercise influences muscle glycogen restoration[4,5]. This information is especially important for endurance athletes since CHO type and blood glucose response is important in order to optimize CHO intake either pre or post exercise.

For example, CHO ingestion immediately prior to exercise has been reported to have a negative effect on exercise performance [6]. If an athlete consumes carbohydrate-rich foods or sport drinks within 60 minutes of the beginning of an endurance exercise performance, the glucose from the ingested food or drink enters the circulation within minutes of ingestion. The subsequent rise in blood glucose concentration causes the release of the hormone insulin, which assists in clearing glucose from the

circulation. A peak in insulin concentration in the blood occurs at the time exercise begins. Consequently glucose uptake by the muscles reaches an abnormally high rate during the exercise performance. Therefore, the consumption of simple CHO, which are digested and absorbed quickly, can be detrimental to exercise performance [6].

This high rate of clearance glucose from the blood can potentially cause hypoglycemia which in turn can produce symptoms of acute fatigue. In summary, consuming high-glycemic CHO immediately before exercising causes blood glucose to rise rapidly (glycemic response) which may trigger excessive insulin release (insulinemic response) [7, 8].

In contrast, consuming low glycemic carbohydrate-rich foods (starch with high amylose content or moderate glycemic CHO with high dietary fiber content) in the immediate 45-60 minute pre-exercise period allows for slower glucose absorption, reducing the potential for rebound glycemic response. Typically, the optimal forms of CHO have been combinations of glucose, fructose, sucrose, and maltodextrins with or without protein or amino acids and it has been further suggested that the glycemic index of food may be a key determining factor for when food is ingested relative to exercise participation [9-14].

Currently there are many sport drinks that help the body replenish CHO levels during exercise including pre-exercise formulas whose purpose is to promote the sparing of CHO by facilitating fat substrate utilization during exercise. EM·PACT (Mannatech, Inc.) is an energy and endurance pre-exercise drink (PRX) purported to increase oxygen consumption, reduce lactate production, and improve fat utilization during aerobic activity. Although anecdotal and case study evidence exists giving merit to these claims, little or no laboratory evidence has been available to support the usage of the potentially performance enhancing product for aerobic or endurance performance.

The purpose of this study was to examine the effectiveness of a pre-exercise sport drink (PRX) on indices of maximal cardiorespiratory fitness. Specifically, VO2max and Time to Exhaustion (Time) during graded exercise testing were evaluated.

METHODS

Subjects. In this investigation, twelve male and twelve female college students (n = 24), ages 18-24 years (20.25 $\pm$ 1.42), volunteered as subjects. Subjects signed university-approved informed consent statements in compliance with the institution's research review board on the campus in which the study was conducted.

Study Design. Subjects involved in this study were asked to submit to "two" maximal oxygen consumption tests (VO_2max) within a week of each other with at least 48 hours between trials. Subjects were required to perform each maximal effort exercise test on a motor-driven treadmill. In addition, expired lung gases were examined for the purpose of determining the amount of oxygen used during exercise for VO_{2max}. Expired lung gases were collected by sampling air exhaled from the mouth into a mouthpiece connected to sampling hoses and gas analyzers (CPX system, Medgraphics, Maple Grove, MN). The exercise intensity began at a low level and was advanced every three minutes by increasing the speed and incline of the treadmill belt using Bruce protocol [15]. During the test, heart rate and time were measured continuously while blood pressure and ratings of perceived exertion were measured toward the end of each three minute stage. VO_2max was considered to have been achieved if the subject met at least two of the following criteria: 1) an RER equal to or greater than 1.15 2) plateau of VO_2 during the last stage of exercise 3) maximal heart rate within $\pm$ 10 beats per minutes of predicted values.

Prior to test participation, subjects were asked to adhere to the following pre-test instructions: 1) wear comfortable, loose-fitting clothing 2) drink plenty of fluids over the 24-hour period preceding the test 3) avoid food, tobacco, alcohol, and caffeine for 3 hours prior to taking the test 4) avoid exercise or strenuous physical activity the day of the test and 5) get an adequate amount of sleep (6 to 8 hours) the night before the test [15].

Testing Procedures. Each subject arrived thirty minutes prior to each exercise trial and was given either the recommended dosage (1 Tablespoon/18 g per 8 ounces/.24 L water) of PRX or a placebo (citrus flavored water) twenty minutes prior to test participation. Administration of PRX and placebo trials were randomized with half of the subjects ingesting the placebo during the first trial and PRX during their second trial with the order reversed for the remaining subjects. Total participation time for each test was approximately 1 hour. The PRX supplement (EM·PACT) was provided from Mannatech, Inc., Coppell, TX in sealed bottles and an

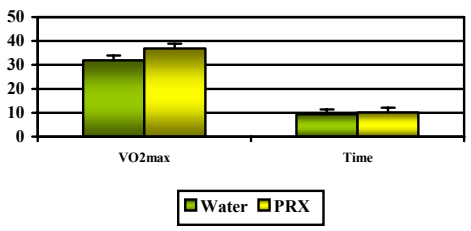
open-label format with an unbiased assistant (not involved in the testing or data analysis) mixing the PRX and providing it to the subjects. Both the PRX and water placebo were provided by an assistant blinding both subjects and investigators as to the order in which water placebo or PRX was ingested. At the end of the study investigators were provided information as to the order in which the subjects were provided either the PRX or water placebo. EM·PACT is a citrus flavored 7.2% carbohydrate-electrolyte concentration energy and endurance pre-exercise drink containing a proprietary blend of the following ingredients (Total 18 g/dose): Energy and Endurance Complex Fructose (14.58 g), citric acid (1.55 g), silicon dioxide (.54), medium chain triglycerides (.25 g), creatine monohydrate (.19 g), calcium citrate (.16 g), magnesium aspartate (.13 g), magnesium succinate (.13 g), potassium aspartate (.13 g), potassium succinate (.13 g), lemon oil powder (.09 g), choline bitartrate (.05 g), L-carnitine (.05 g), Ambrotose (Aloe vera extract: Manapol), Powder (.03) and lecithin (.01 g).

Statistical Analysis. Data were analyzed with paired sample t-tests. VO_2max ($ml \cdot kg^{-1} \cdot min^{-1}$) and Time (minutes) were the specific dependent variables examined in this study. In addition measures of effect size were also calculated. An alpha level of .05 was used in determining statistical significance. Statistical analyses were performed using SPSS for Windows version 12.0 statistical package (SPSS, Inc., Chicago, IL) [16]. Data are presented as means $\pm$ SE for water and PRX trials.

RESULTS

Initial results indicated significantly greater mean values in VO_{2max} ($ml \cdot kg^{-1} \cdot min^{-1}$) for the PRX trial compared to the placebo (water) trial $t(23)=5.82$, $p<.001$. It was also found that the PRX trial exhibited significantly higher mean values in time to exhaustion (minutes) when compared to the placebo trial $t(23)=4.47$, $p<.001$. Overall differences in the various parameters are depicted in FIGURE 1. Changes in mean values among the reported variables are displayed in TABLE 1.

Figure 1



DISCUSSION

The main findings of this study were that indices of cardiorespiratory fitness, specifically VO_2max, and time to exhaustion were significantly ($p<.05$) enhanced by ingestion of PRX prior to graded exercise testing. In particular, overall increases were observed in VO_2max (15.5%) and time to exhaustion (8.7%). The results of this study also support the use of the PRX as examined in this investigation in tests of aerobic power as well as support earlier reports of ingesting a PRX consisting of low glycemic sugars (5-8%) before exercise [9-14].

Improvement of time to exhaustion claims also could possibly be substantiated as the data of this investigation support a recent study in which a mixture of CHO and medium-chain triglycerides (MCTs) resulted in increased aerobic function as marked by increases in length of time trials to exhaustion [17]. Marketing for the sports enthusiast hypes MCTs as fat burners, energy sources, glycogen sparers, and muscle builders. Although MCTs do not inhibit gastric emptying as does common fat, conflicting research supports the efficacy of using MCTs solely as a means of improving fat oxidation during exercise[18,19] and because of its minimal contribution to the formula, the individual contribution of MCTs in improving performance is highly unlikely. However, subsequent research investigating possible metabolic and ergogenic effects of combining MCTs with CHO may hold promise. It was concluded that, during bouts of exercise requiring aerobic power, the combined results of this investigation provide meaningful practical applications for coaches and athletes alike regarding possible alternative hydration options.

Future research is warranted investigating blood lactate levels, fuel substrate utilization, gender differences, fitness levels, comparisons with other products, as well as use under various environmental and competitive conditions. In addition, further research is needed to determine if other ingredients or combinations of ingredients included in the mixture of this PRX may have influenced the results. For example, creatine monohydrate is included in this mixture, however; its amount (.15 g/dose) is probably negligible in producing any ergogenic benefit due to the limited amount and timing of the ingestion period and lack of any prior loading of creatine monohydrate by the subjects. Also, L-carnitine (.04 g/dose) has been demonstrated to have an ergogenic effect (mixed reports) however; as with the creatine the amount and the timing are probably prohibitive

concerning any benefit [3]. Although the results of this study favor using this particular PRX, caution should be taken regarding the findings since it is difficult to provide a feasible scientific rationale why any significant findings occurred based on the content of the product.

To the author's knowledge, no previous research has shown similar significant acute results utilizing a proprietary blend of ingredients primarily designed for use as a concentrated sports drink. In effort to substantiate or refute the efficacy of this product noted in this study, additional studies are most certainly warranted.

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Table 1. Mean changes in various parameters

Variable	Water M SD	95% C.I.	PRX M SD	95% C.I.	% Increase	Effect Size
VO_2max (ml·kg^{-1}·min^{-1}) (n=24)	31.95 ± 6.55	29.18 - 34.72	36.89 ± 7.16	33.86 - 39.91	15.5*	1.19
Time (minutes) (n=24)	9.34 ± 2.24	8.40 - 10.29	10.14 ± 2.22	9.21 - 11.09	8.7*	1.29

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