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Effects of a Herbal Ergogenic Drink on Cycling Performance in Young Cyclists

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ABSTRACT

It is essential to replace fluids lost so as to remain well hydrated during exercise. The intake of fluids is considered a physiological ergogenic aid to enhance exercise performance. There are currently several products in the market that are believed to have ergogenic properties which act as fluid replacement drinks during exercise. One such drink available in the Malaysian market is 'AgroMas®' herbal drink whose efficacy is yet to be proven. The purpose of this study was, therefore, to evaluate the effects of acute ingestion of this herbal drink (H) or a coloured water placebo (P) on cycling performance. Nine healthy and trained young male cyclists (age: 16.2 ± 0.5 years) exercised on a cycle ergometer at 71.9 ± 0.7% of maximal oxygen consumption (VO_2max) until exhaustion on two occasions at 1-week intervals. During each exercise bout, subjects received 3ml kg^{-1} body weight of H or P every 20 min in a double-blind randomised study design. There was no significant difference between H and P trials in the total work time to exhaustion (83.7 ± 4.6 and 81.5 ± 5.0 min respectively). Changes in oxygen consumption, heart rate and perceived rate of exertion were similar for both types of drinks. These results demonstrate that the herbal drink and the placebo elicited similar physiological responses and exercise performance during endurance cycling. It is therefore concluded that AgroMas® herbal drink and water ingestion resulted in a similar ergogenic response on cycling performance in young cyclists.

INTRODUCTION

Athletes and coaches the world over use ergogenic aids such as nutritional supplements, new-designed equipment and special training methods to enhance exercise performance. One such aid is fluid replacement during exercise which is considered a physiological ergogenic aid. Excessive sweating during exercise leads to serious fluid loss and a reduction in plasma volume. This can cause circulatory failure, and core temperature may rise to lethal levels (Gisolfi & Coping, 1974; Sawka *et al.*, 1985; Coyle, 1998; Sawka & Coyle, 1999). The most effective defense against dehy dration and heat stress is adequate hydration (Hamilton *et al.*, 1991; Montain & Coyle, 1992b; Montain & Coyle, 1993). This is achieved by balancing water loss with water intake. The prime aim of fluid replacement is to maintain plasma volume, so that circulation and sweating can progress at an optimal level (McArdle *et al.*, 1991; Coyle, 1998; Sawka & Coyle, 1999). Numerous studies regarding fluid intake as an ergogenic aid during exercise have used carbohydrate-electrolyte solutions as fluid replacement during exercise (Frizzel *et al.,* 1986; Coleman, 1988; Coyle, 1988; Ferreire & Walker-Smith, 1989; Murray *et al.,* 1994; Shi *et al*., 1995). However, other drinks like caffeine-free and nonalcoholic fluids too can be used as fluid replacement during exercise; they also serve as ergogenic aids (Clark, 1997).

There are now several products in the market believed to have ergogenic properties besides serving as replacement fluids during exercise. Among such drinks are herbal drinks such as *Eurycoma longifolia,* Ginseng, Lohan gua, Chrysanthemum and Aloe vera. However, studies on the effect of herbal drinks during exercise are limited. Since there is no scientific evidence for the use of 'AgroMas®' herbal drink as an ergogenic aid to enhance endurance performance, it is therefore proposed that the effect of 'AgroMas®' herbal drink during endurance exercise be investigated. The aim of this study was to evaluate the effects of 'AgroMas®' herbal drink on endurance performance during cycling exercise in young cyclists.

METHODS

Subjects

Nine well-trained young male cyclists participated in this study after giving their written, informed consent. Their age, height, weight and VO_2 max were (mean ± SEM) 16.2 ± 0.5 years, 163.5 ± 2.5 cm, 56.2 ± 1.6 kg, and 56.9 ± 2.2 ml kg^{-1} min^{-1} respectively. The study was approved by the Research Ethical Committee of Universiti Sains Malaysia.

Preliminary testing

A progressive maximal exercise test was performed to obtain each subject's maximal oxygen uptake (VO_2 max) using an electromagnetically-braked cycle ergometer (Excalibur Sport, Lode, Groningen, The Netherlands). Based on the measured VO_2max and VO_2 values from steady-state exercise, exercise intensity for warm-up and experimental trial was established which elicited a VO_2 of 50%, 70% and 80% of VO_2 max.

Endurance trial

The subjects cycled until volitional exhaustion on an electromagnetically-braked cycle ergometer at a workload requiring 70% VO_2max for the first 90 minutes and 80% VO_2max thereafter (Okano *et al*., 1988) on two different occasions, separated by approximately a week. The subjects were instructed to ride at 60 RPM and exhaustion was defined as the point when they could no longer maintain 40 RPM despite verbal encouragement. Both trials were per formed in the laboratory under similar experimental and environmental conditions (23.9 ± 0.2 ^{o}C and 64.7 ± 1.5% relative humidity). A fan directed air towards the subjects. On each occasion, the subjects were randomly assigned to consume either the herbal drink (H) or placebo solution (P) (3 ml kg^{-1} body weight) in a series of feedings every 20 min during the cycling endurance performance trial. The composition of the herbal drink and placebo used in this study are listed in Table 1. The order of the two trials was randomised and a double blind cross-over design was used.

To produce a uniform homogenous physiological state among subjects, dietary and exercise restrictions were established. Each subject was instructed to record his diet for 72 hour prior to the first endurance trial session and to eat the same diet preceding the second trial. In addition, they refrained from training or strenuous exercise 24 hour prior to the endurance trials but maintained similar training volume and intensity throughout the duration of the study.

For the preliminary tests and experimental trials, the subjects were fitted with a head gear which supported a one- way non-rebreathing mouth piece (Vacuumed 2700B). A paramagnetic oxygen analyser and an infra-red carbon dioxide analyser (SensorMedic 2900) were used to determine the percentages of oxygen and carbon dioxide respectively in expired air sample taken during the investigation. Both analysers were calibrated daily using nitrogen based calibration gases.

Table 1. Physical and physiological characteristics of the subjects (n=9) (Mean ± SEM)

Parameter	Mean ± SEM
Age (years)	16.2 ± 0.5
Height (cm)	163.5 ± 2.5
Weight (kg)	56.2 ± 1.6
VO_2 max (ml kg^{-1} min^{-1})	56.9 ± 2.2

VO_2 max, maximum oxygen uptake

Table 2. Composition of the test drinks per 100 ml

Composition	'AgroMas®' Herbal Drink	Placebo
Eurycoma longifolia/ Tongkat Ali (mg)	0.1	–
Cinnamomum cassia (Presl) (mg)	2.0	–
Calcium (mg)	2.886	2.886
Sodium (mg)	1.056	1.056
Potassium (mg)	0.860	0.860
Phosphate (mg)	<0.003	<0.003

On each visit, the cyclists reported to the laboratory after a 10-12 hour fast. Subjects were encouraged to consume water during the fast and before the tests. On reporting to the laboratory, a heart rate monitor (Sport Tester PE3000, Polar Finland) was secured on the chest by attaching it onto an elastic belt.

After sitting on the cycle ergometer for five minutes, resting heart rate and expired gas were measured. The subject was then asked to warm-up for five min by cycling at 50% VO_2max. Expired air was collected during the final minute of the warm-up. Immediately after the completion of the warm-up, the intensity of cycling was increased to 70% VO_2max and the clock started. Immediately after completion of the warm-up, at intervals of 20 min subsequent to the warm-up, 3 ml kg^{-1} body weight of the assigned cooled fluid (8^oC) was consumed by the subjects via plastic volumetric syringes. Expired air samples and heart rate were taken at intervals of 10 min. Subjective ratings of perceived exertion (PRE) was obtained every 20 min using the traditional Borg's Scale (Borg, 1973; Borg, 1975). Intensity of cycling was increased to 80% VO_2max after 90 min of cycling at 70 % VO_2max.

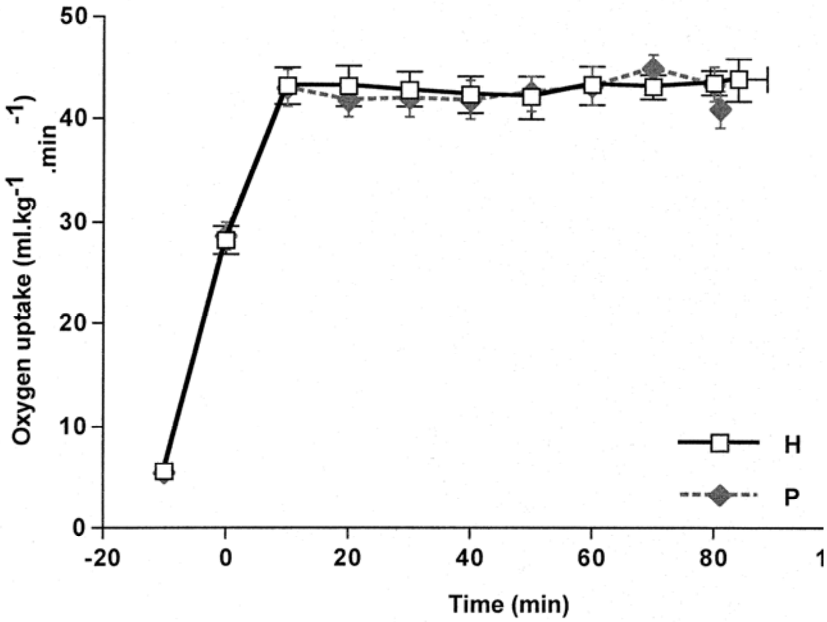

Figure 1. Oxygen uptake (ml $kg^1 min^{-1}$) of the subjects during the herbal drink (H) and placebo (P) trials (Mean ± SEM)

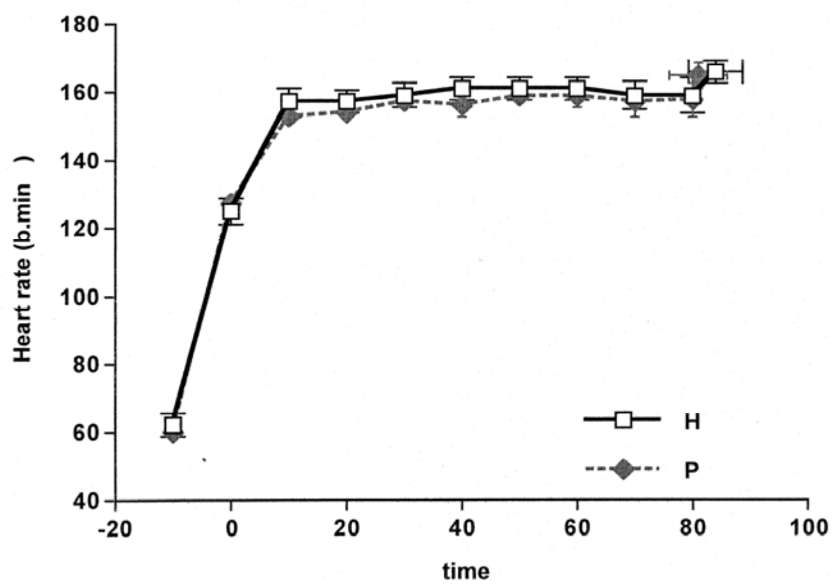

Figure 2. Heart rate ($b.min^{-1}$) responses of the subjects during the herbal drink (H) and placebo (P) trials (Mean±SEM)

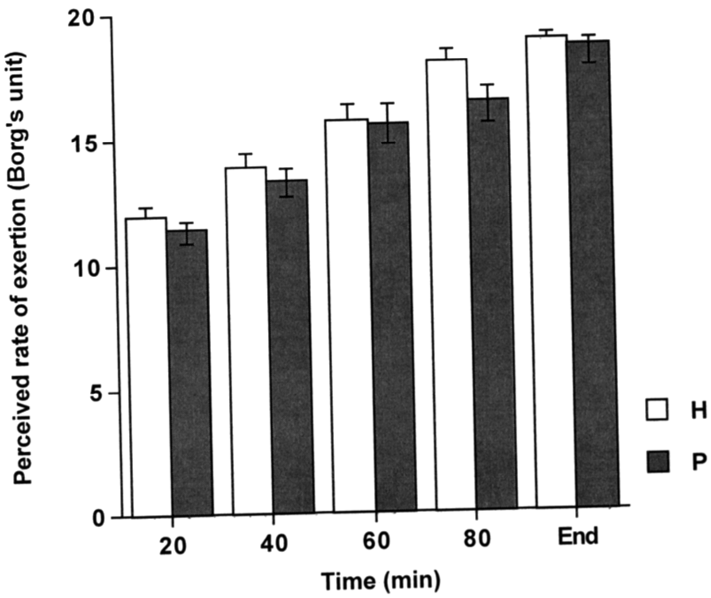

Figure 3. Perceived rate of exertion (PRE) of the subjects during the herbal drink (H) and placebo (P) trials (Mean ± SEM)

Statistical analysis

Cycling time, changes of VO_2, heart rate and PRE with herbal drink and placebo treatment were analysed using a one way analysis of variance (ANOVA) and paired t-test. The Statistical Package for Social Sciences (SPSS) programme was used for statistical analysis. Differences were considered significant at $p<0.05$. Results were presented as mean ± SEM.

RESULTS

Endurance cycling time was 3.4% longer with the herbal drink compared with P, 83.7 ± 4.6 min versus 81.5 ± 5.0 min, but it was not significantly different.

Oxygen uptake (VO_2) was similar between the H and P trials, averaging 41.5 ± 0.7 ml $kg^{-1}min^{-1}$ and 41.2 ± 0.7ml $kg^{-1}min^{-1}$ respectively (Figure 1). The mean $\%VO_2max$ sustained during the H and P trials were similar at 72.2 ± 1.3% and 71.6 ± 0.5% respectively. There was no signify cant difference in the heart rate responses between the H and P trials (mean: H: 156 ± 2 b min^{-1} vs mean: P: 155 ± 2 b min^{-1}). Heart rates at time of exhaustion for the H and P trials were 166 ± 3 b min^{-1} and 165 ± 4 b min^{-1} respectively (Figure 2). The perceived rate of exertion (PRE) increased significantly ($p < 0.001$) from min 20 to the end of the test in both the H and P trials (Figure 3). In the H trial, PRE increased from 12.00 ± 0.37 Borg units at 20 min of exercise to 18.89 ± 0.26 Borg units at exhaustion, whereas in the P trial, PRE increased from 11.44 ± 0.29 Borg units at 20 min of exercise to 18.67 ± 0.24 Borg units at exhaustion. There were no significant differences in PRE during exercise at any time point between the H and P trials (Figure 3).

DISCUSSION

The most noteworthy finding of this study was the lack of the ergogenic effect of the herbal drink which resulted in similar exercise time to exhaustion with the coloured placebo (P) drink. One of the reasons for the absence of a significant difference in cycling time could be due to the lack of carbohydrates in the herbal drink. In the present study, the herbal drink did not contain any carbohydrate, thereby making it less suitable as a sports drink for fluid replacement during endurance exercise. Numerous studies have shown evidence that a 6–8% carbohydrate level in drinks helps to enhance endurance performance (Coyle *et al.*, 1986; Coleman, 1988; Davis *et al.*, 1988; Montain & Coyle, 1992a; Tsintzas *et al.*, 1996; Jeukendrup *et al.*, 1997). The per formance-enhancing effect of carbohydrate feeding has been attributed to a sparing of muscle and liver glycogen stores and maintenance of blood glucose level (Coyle *et al.*, 1986). Since the herbal drink in the present study did not contain any carbohydrate, the contribution of carbohydrate to enhancement of cycling time could not be established.

The present study also indicates that the herbs in the herbal drink do not enhance cycling time and may have no ergogenic properties. One of the possible reasons could be due to the low concentration of herbs, for example *Eurycoma longifolia* Jack, in the drink. Hence, further studies using a higher concentration of this herb is warranted.

Oxygen uptake and heart rate are indicators of exercise intensity (McArdle *et al.*, 1991). In the present study, the herbal drink and placebo trials had similar oxygen uptake, averaging 41.5 ± 0.7 ml kg^{-1} min^{-1} and 41.2 ± 0.7 ml kg^{-1} min^{-1} respectively (Figure 1). There was also no significant difference in percentage maximum oxygen uptake during the H and P trials, where the mean percentage maximum oxygen uptake were 72.2 ± 1.3% and 71.6 ± 0.5% in the H and P trials respectively. This data showed that exercise intensity was similar in both the H and P trials, and subjects have cycled at an appropriate exercise intensity of about 70% VO_2max, which was predetermined for this study.

Mean heart rates during the endurance trials were similar between the H (156 ± 2 b min^{-1}) and P trials (155 ± 2 b min^{-1}) (Fig. 2). These heart rates recorded were appropriate values for work at 70% VO_2max as similar rates were also observed by Davis *et al.* (1988) where the heart rates averaged 155 b min^{-1} to 175 b min^{-1} throughout all exercise sessions while the subjects cycled for 2 h at 75% VO_2max.

In addition to oxygen uptake and heart rates, the rating of perceived exertion (PRE) was also used as an indicator of exercise intensity (McArdle *et al*., 1991). The PRE increased significantly from 20 min to the end of the test in both the H and P trials i.e. from 12.00 ± 0.37 Borg units to 18.89 ± 0.26 Borg units in the H trial and 11.44 ± 0.29 to 18.67 ± 0.24 Borg unit in P trial (Fig. 3). It is clear from the PRE that exercise became progressively difficult for the subjects throughout the trials. This finding is in agreement with previous investigations that reported an increase in PRE during exercise (Below *et al.*, 1995; Montain & Coyle, 1992a & b). Since there were no significant differences in PRE during exercise at any time point in the H and P trials, this indicates that subjects were exercising at a similar exercise intensity.

In conclusion, the results of this study showed similar endurance time, oxygen uptake, heart rate and the perceived rate of exertion for both 'AgroMas®' herbal drink and placebo trials. These results showed that the 'AgroMas®' herbal drink and placebo elicited similar ergogenic effects during endurance cycling. Since the herbal drink produced similar response to water (placebo) ingestion, it can be recommended that the herbal drink be used for physical activity shorter than 60 min duration where replacement of fluids is more important than carbohydrate supplementation.

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