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Research Article

The Effect of Mixed Cherry-carrot Juice Sports Drink on Physical Performance in Long-distance Runner

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Abstract: The Objective of study is to investigate the effect of long-term supplement mixed cherry-carrot juice sports drink on long-distance runner physical performance. 22 subjects were randomly divided into two groups for two-phase cross, double-blind placebo-controlled trials, each stage of the intervention was four weeks and 4-week-Wash-out phase was between two intervention phases. Before and after 4 week crossover phase, Oxygen uptake dynamics and physical performance test was performed, before and after which the sample of blood and urine was collected. After intervention the average Watt and RPM of C group was higher than P group in 20 km test, the t of oxygen uptake kinetics of C group was faster than P group. After intervention, no group change of antioxidant capacity was observed between C and P beside T-AOC, whose group difference from pre-intervention to post-intervention was significant. The significant group difference of 8-isoPGF2a from pre-intervention to post-intervention was observed in post-exercise status. After long-term mixed cherry-carrot juice sports drink intervention, physical performance and oxygen uptake kinetics parameters are improved in long-distance runner. Total antioxidant capacity of plasma is increased; the changes of Oxidative stress injury markers are reduced.

Keywords: Cherry-carrot juice, long-distance runner, physical performance, sports drink

INTRODUCTION

Prolonged high-intensity strenuous exercise causes an increased production of free radicals, when generating free radicals exceed the body's antioxidant defense system scavenging capacity, causing oxidative stress. With the increasing level of oxidative stress injury, the development of exercise-induced fatigue is prompting, causing decreased exercise capacity, which is one of the mechanisms of fatigue resulting movement; at the same time, with high-intensity training, micro-damage is accumulating oxidative stress and cell to induce the body's inflammatory response, it would further exacerbate the production of free radicals, thereby allowing the degree of oxidative stress deepening, these might adversely affect the health of the body, causing chronic inflammation of the body, decreasing immunity and so on; endogenous supplementary reasonably increase the antigens of supplements, assisting to clear high-intensity exercise, or control the body of free radicals generated in the normal physiological range, may have the ability to produce good athletes in impact and eliminate the adverse effects of long-term high-intensity training on the body's health.

Cherry fruit is warm and sweet, it can increase blood circulation, tune in spleen, benefit liver and remove the effect of the heat. Cherries are rich in anthocyanin, p-cumaric acid, gallic acid, worthy of a non-alcoholic, perilla alcohol, melatonin and quercetin which is a natural and effective antioxidant (Yan and Zhang, 2008). The study found 100g concentrate sour cherry juice is able to provide 12800U (Wu *et al*., 2004), ranking No. 14 in containing high antioxidant foods, over the famous dark chocolate, red wine and orange juice (Halvorsen *et al*., 2006). Carrot is known as "little ginseng", which contains a high nutritional value of vegetables, rich in VA and β-carotene, protect eyesight, promote bone growth and development, improve the function of the human immune system and other aspects (Sun *et al*., 2011). With cherries and carrot juice as the main raw material, add nutrients which can both be used in sports drinks or some other auxiliary materials from the preparation of combination, immune regulation, thirst, fatigue and other functions.

This test uses a double-blind crossover design, to explore the long-term complement complex effect of cherry-sports drink carrot juice on long-distance runners athletic ability and antioxidant capacity, aims for the development of sports drinks provide data for reference.

MATERIALS AND METHODS

Materials: Screened from the Shanxi Provincial Sports School which has a more than 3 years training experience in the middle and long distance. 22 healthy

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Table 1: The basic information of subjects

Designation	Group A (n = 11)	Group B (n = 11)
Height /cm	173.9±4.9	174.7±4.0
Body mass/kg	58.70±6.3	60.9±3.90
Age/years	16.70±6.3	17.0±4.10
training age /a	3.90±2.00	4.01±1.80
O_2max /(mL/min/kg)	60.4±3.90	59.1±3.20
HRmax /(b/min)	190.4±6.5	189.5±8.4
70% V_{O2max} load/w	189.8±17.6	185.9±21.3

men athletes were randomly divided into A, B groups, basic information on the subjects are shown in Table 1, both groups are not basic indicators who can see a significant difference ($p>0.05$).

In accordance with the literature (Sun and Fang, 2014) provides a composite formulations processed into bottled cherries-sports drink carrot juice (C), a bottle of 500ml, placebo-controlled drinks (P) by pure water plus organic pigment composition, taste and C similar. Subjects in accordance with the requirements of the afternoon nap after a day of fasting and drank a bottle of each.

Power Middle Distance (Monark894E, Sweden), cardiopulmonary exercise performance telemetry system (Cosmed K4b2, Italy), 722 type-visible spectrophotometer, DG5033 microplate reader, SK-1 Mixer, HH4 thermostatic water bath, 80-2 type low-speed centrifuge, Sartorius BS110S electronic scales and so on.

Experimental design: Study randomly, double-blind, two-period crossover, placebo-controlled trial design, subjects were divided into A, B groups, the order of A group of subjects takes the product of the intervention: the first composite cherry drink-sports drink carrot juice C (phase i intervention) and then placebo-control crossover intervention before drinking beverages P (first intervention phase ii); opposite group B and group A intervention order. Each stage of the intervention 4 weeks, conduct fitness tests before and after each intervention phase, each physical urine collected blood samples before and after the tests.

Experimental intervention and monitoring: Each intervention stage fitness test after the end of the formal entry into the sports drinks intervention participants who receive 56 per bottle beverage C or P intervention trial design according to the order of two bottles a day. During the intervention, the research staff of tracking and monitoring the situation subjects drinking sports drinks and diet records and the training subjects. Phase i intervention period (cross-intervention period) replacement drink, repeat ii stage fitness test blood samples and urine samples. Washout period subjects were normal training but can prohibit the use of any professional sports drinks and sports supplements. Cross-intervention period and Phase 1 diet and training were quite non-significant difference ($p>0.5$) for both groups the average weekly training volume and the amount of training in two stages in the week. During the intervention diet plus for this test can not affect the other components, you can not drink any other professional sports drink.

Blood processing and the main test indicators and test methods: Every extracted venous blood collection tubes with heparin, under 4°C 2000 rpm for 10 min, 0.5 mL were collected from the upper plasma divided into two EP tubes stored at -80°C for test plasma total antioxidant capacity (T-AOC), total superoxide dismutase (T-SOD), glutathione peroxidase (GSH-PX), Malondialdehyde (MDA) and so on. 3 mL urine under 4°C 3 000 rpm for 10 min, the supernatant 1 mL, -80°C refrigerator tested 8- heterogeneous prostaglandin (8-isoPGF2α). T-SOD using hydroxyl ammonia, T-AOC, GSH-PX colorimetric, MDA take thiobarbituric Act (TBA), 8-isoPGF2α by enzyme-linked immunosorbent assay (ELASA), all kit from Nanjing Jiancheng Bioengineering Co. provided the testing process in strict accordance with the kit instructions.

Statistical methods: Data statistically analyses, using SPSS19.0, exercise capacity parameters, oxygen kinetics parameters, blood biochemical parameters before and after the intervention, the difference between the change (Δ) uses the analysis of variance two-period crossover design, in which the intervention phase (period, 1vs 2) and intervention products (treat, C vs P) as fixed factors and subject (subject) as a random factor; participants basic information, training, compared to the situation with independent sample t test, all test results were expressed as mean±standard test using two-sided test, $p<0.05$ indicate a significant difference. According to the statistical results of the intervention products, divided into composite cherry-carrot juice in the intervention group (Cherry-carrot, represented by C) and placebo-controlled intervention group (Placebo, with P), before and after the motion detection parameters are represented as "Quiet value" and "after exercise."

RESULTS AND ANALYSIS

Athletic ability between groups related parameters change analysis: Beverages under different interventions, 20 km of power, heart rate, speed and other information timed test analysis are shown in Table 2 below. Before the intervention, all parameters between groups were not significant ($p>0.05$), after the intervention, C and P intervention compared to the intervention, 20 km of power, speed and oxygen consumption kinetics parameter t values were significantly different ($p<0.05$).

Change of intervention between plasma antioxidant index group: After the intervention of the two-stage

Table 2: Exercise capacity changes in the experimental group and control group before and after intervention

	CG		PG	
Variables	Before the intervention	After the intervention	Before the intervention	After the intervention
Power/w	180.2± 36.1	210.3±34.1*	168.7±51.6	171.5±39.3
Heart rate/(b/min)	161.1±12.1	158.8±17.3	157.7±14.6	160.3±14.2
revolving speed/(r/min)	91.10±13.1	94.2±13.9*	89.3±18.7	90.7±25.6
VO2max /(mL/kg/min)	60.70±4.10	61.7±6.3	60.3±5.50	61.2±5.6
Bal VO2/(mL/min)	600.7±33.6	586.8±41.2	594.6±40.2	581.7±383
t/s	27.10±2.80	26.4±3.7*	25.8±4.20	25.7±3.8

CG: cherries-sports drink carrot juice group; PG: placebo group.*: indicates a significant difference ($p<0.05$) in group CG and PG. (The next table is the same)

Table 3: Plasma antioxidant capacity change after the intervention

Index		CG	PG	F	P
T-AOC/(U/mL)	Quiet t	18.97±2.41	17.99±2.97	1.530	0.276
	After exercise	22.73±2.01	20.05±2.53	17.913	0.012*
	Δ	-2.96±3.58	-0.91±3.36	4.132	0.043*
T-SOD/(U/mL)	Quiet t	47.89±6.01	47.76±6.03	0.171	0.678
	After exercise	52.97±10.76	50.91±9.58	1.621	0.207
	Δ	-4.96±8.49	-3.21±7.12	0.901	0.368
GSH-PX/(U/mL)	Quiet t	209.07±2.61♀	208.72±18.63	0.049	0.938
	After exercise	210.61±16.01	210.07±18.09	0.018	0.891
	Δ	-1.450±15.71	-1.19±14.68	0.029	0.937

Δ: Denotes that is the difference between the quiet value with after exercise; ♀: denotes a difference between the experimental groups. (The next table is the same)

Table 4: The change of oxidative stress injury in plasma and urine after the intervention

Index		CG	PG	F	P
MDA (nmol/mL)	Quiet t	2.29±0.69	2.73±0.46	0.019	0.971
	After exercise	2.90±0.83	2.79±0.71	0.102	0.757
	Δ	-0.54±0.96	-0.47±0.83	0.079	0.781
8-isoGPF2α	Quiet t	340.2±42.9≠	343.8±58.1	0.116	0.741
	After exercise	439.6±50.9	459.1±57.4	1.401	0.253
	Δ	-101.9±50.7	-118.2±59.5	0.613	0.451

≠: Indicates there was significant difference on the I intervention stage and the II intervention stage ($p<0.05$)

antioxidant index crossover trial analysis of variance showed, C and P intervention comparison group and the difference between the value of the difference and quiet after plasma T-AOC movement significantly after exercise intervention C T-AOC activity significantly higher than P intervention to be high and T-SOD, GSH-PX two indicators such cases no significant difference between sex groups, while GSH-PX observed individual differences (Table 3).

Intervention lipid oxidation index change analysis: Lipid peroxidation parameters results in the following table, after the intervention, MDA, before and after the intervention had no significant difference between group differences, after the intervention, 8-isoGPF2α quiet stage differences and values exist under 8-isoGPF2α,various states are shown in Table 4.

DISCUSSION

Composite Cherry-sports drink carrot juice can improve athletic ability is the focus of attention in this study. Early studies showed that antioxidant cherry extract has strong antioxidant activity in vitro and in vivo, with a class SOD activity, is a worthy deep development of new antioxidants alternatives (Kang *et al*., 2003). Cherry antioxidant serum extract can significantly enhance the activity of GSH-Px and SOD mice and liver, reduce the content of MDA, SOD and GSH-Px are the body's most important antioxidant enzymes, which enhance the activity, the inevitable can reduce the damage of lipid peroxides, MDA content decreased, thereby reducing reactive oxygen species damage to the immune system, enhancement of endogenous oxygen free radical scavenging systems (Seymour and Singer, 2007). Carrot polysaccharide on · OH, O_2^-, DPPH radical scavenging ability with strong, for yolk lipoprotein lipid peroxidation has a certain extent (Davis *et al*., 2009).

In a double-blind randomized crossover study in trial, 2h 70% VO_{2max} load power cycling fitness test some of its objectives is to stimulate the body's transition oxidative stress through its prolonged exercise and thus to observe cherries-carrot juice supplement 20km subsequent fitness tests affect sprint performance. From the test results, 20km physical fitness test, cherry-carrot juice intervention group average power and speed ride comfort than the control group was significantly higher, suggesting a period of four weeks of cherries-carrot juice intervention may improve the 2 h 70% *VO_{2max} load power cycling of oxidative stress, thereby reducing the impact on the

physical fitness tests the ability of skeletal muscle to work to improve athletic performance in this test.

In addition, the study of oxidative tonic effect on athletic ability and athletic ability is more of a level of aerobic endurance and an important indicator of the level of aerobic endurance is *VO_{2max}. Mark Davis In 12 healthy male subjects did not train for a period of seven weeks of cherries-Intervention carrot juice (1000 mg/D) found that compared to the control group and comfort, cherry- carrot juice in the intervention group VO2max degree increase. However, in this study, did not observe significant changes in $VO_{2max.}$ I believe that VO_{2max} is improved by various effects, such as the training and other subjects. Research subjects are more than 3 years experience of training middle distance runner, VO_{2max} and exercise levels were significantly higher than the Mark research and for these excellent, trained athletes, their VO_{2max}, mitochondrial density, resistance oxidative capacity may have reached some kind of platform, the main factors restricting their exercise capacity may not be that VO2max levels.

In addition, the kinetic parameters is from the oxygen consumption, the study also observed more significant changes. In this study, oxygen uptake kinetics is another evaluation to reflect the level of endurance. Movement is a reflection of the body's oxygen uptake kinetics from the movement began to enter the dynamic process of working steady oxygen intake, exercise different intensity, oxygen uptake kinetics showed different characteristics exponential function. Different people, different level of training athletes, oxygen uptake kinetics showed different differences. Patients with cardiovascular disease, oxygen uptake kinetics speed significantly slower than in healthy persons; oxygen uptake training can significantly change the dynamic conversion speed, high level of training of athletes, from quiet to moderate load even when oxygen uptake kinetics during high-intensity exercise speed is significantly faster than the poor level of training, which may reduce the oxygen deficit during exercise load conversion, increased exercise tolerance time; Mark and so that all levels of athletic ability, especially endurance limit or development, you can force the oxygen uptake learn to find the answer, therefore, to explore the control mechanism of oxygen uptake kinetics help us understand the limitations of aerobic endurance levels and provide strategies for the development of this capacity (Burnley and Jones, 2007). From our studies, although the C group and P group Bal VO_2 did not change significantly, but τ value as oxygen uptake kinetics reflect one of the important parameters which is significantly reduced, which reduces the amplitude of the control group was significantly higher than that comfort. This suggests that long-term compound Cherry - sports drink carrot juice intervention is to improve the body's different energy conversion rate, reducing the accumulated oxygen deficit and improves work efficiency.

Whether oxidative stress levels decrease or increase, the body's anti-oxidative capacity of relevant theoretical analysis, exercise-induced increases in oxidative stress, the activation of antioxidant enzymes becomes more active, causing an increase in antioxidant enzyme activity, thereby reducing lipid peroxidation level, increased antioxidant enzyme activity and lipid peroxidation reduce certain relationship (MacRae and Mefferd, 2006). However, research results, the compound Cherry-sports drink carrot juice supplement improves antioxidant capacity after prolonged exercise A-TOC, but several other effects on antioxidant enzyme activity is not obvious (Burnley and Jones, 2007). In addition, the experiments observed differences in some parameters phased or subject itself discrepancy may be related to the subject of exercise stress levels, physical function, environmental changes and other factors, which need further analysis of the specific reasons.

CONCLUSION

Long-term consumption of compound Cherry-sports drink carrot juice can help middle distance runner improve athletic performance in sports and improve oxygen dynamics significantly.

Long-term consumption of compound Cherry - sports drink carrot juice can make the body's middle distance runner plasma total antioxidant capacity increase, reducing the oxidation of high-intensity exercise after prolonging stress level damage; but still can not fully explain the test campaign causal relationship between changes in the ability to improve the antioxidant capacity.

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