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Effect of an anti-oxidant rich tart cherry and whey drink on the recovery of delayed onset muscle soreness

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Abstract
Delayed onset muscle soreness is that distinctive muscle pain that nearly everyone experiences after intense or unfamiliar exercise, often peaking as long as a day or two later. It is classified as a type I muscle strain injury and presents with tenderness or stiffness to palpitation or movement. For the treatment of DOMS there are growing amount of evidences indicating that free radicals play an important role as mediators of skeletal muscle damage and inflammation after strenuous exercise. It has been postulated that the generation of oxygen free radicals is increased during exercise as a result of increase in mitochondrial oxygen consumption and electron transport flux, inducing lipid peroxidation, Antioxidants defend against the harmful effect of free radicals. Among various sources of antioxidants, fruits and green tea are rich sources, therefore the present study was undertaken to develop an antioxidant rich recovery drink with the addition of whey, tart cherries and green tea. The effect of recovery drink was evaluated using Visual Analog Scale on a group of 90 amateur gymers between the age group of 19 to 35. The result revealed that there was significant reduction in pain recovery time over 7 days.

Keywords: muscle, injury, anti-oxidant, rich tart cherry

Introduction

DOMS stands for Delayed onset muscle soreness. The sensation experienced with this injury can vary from slight muscle stiffness, which rapidly disappears during daily routine activities, to severe debilitating pain which restricts movement. Tenderness is concentrated in the distal portion of the muscle [3, 4, 5-8] and becomes progressively diffuse by 24-48 hours post exercise [4]. The mechanism of delayed onset muscle soreness is not completely understood, but the pain is ultimately thought to be a result of micro trauma – mechanical damage at a very small scale – to the muscles being exercised

The tart cherries contain specialized flavonoids and anthocyanins. Flavonoids are a group of plant substances thought to provide health benefits through antioxidant effects. Within the cells, antioxidants are compounds that "donate" electrons to unstable molecules, also called reactive oxygen species, so they don't have to snatch electrons from other unsuspecting nearby cells. Anthocyanins are antioxidant flavonoids that protect the cells of many body systems. Tart cherries appear to also have anti-inflammatory agents. Acute inflammation is a protective immune response of the body to heal itself increase. An initial acute inflammation response is the dilation of the arterioles and the opening of new capillaries to the area of injury, such as muscle damage from exercise. This protective process often stimulates nerves, which can lead to irritation and pain.

Whey has potent antioxidant activity, likely by contributing cysteine-rich proteins that aid in the synthesis of glutathione (GSH), a potent intracellular antioxidant [20]. GSH is comprised of glycine, glutamate, and cysteine. Cysteine contains a thiol (sulfhydryl) group that serves as an active reducing agent in preventing oxidation and tissue damage. As an antioxidant, glutathione is most effective in its reduced initiation. Practitioners use whey protein products as a source of cysteine to increase intracellular glutathione levels.

As per proven studies muscle soreness is predominantly due to micro trauma structural damage to muscle fibres, DOMS is primarily caused by the body's inflammatory response to exercise [3] and several other variables. To overcome DOMS and recover micro-injuries antioxidants based recovery Drink was made in which whey and tart cherry juice were the main ingredients.

Study design

Phase I: Development of antioxidant based recovery drink.
Phase II: Sensitivity threshold test Sensory evaluation
Phase III: Analysis of antioxidant content of developed product
Phase IV: Analytical Evaluation
Phase V: Study of recovery from DOMS on amateur gymers

Result and Discussion

Table 1: Mean score for different sensory parameters

Attributes	Sample A	Sample B
Taste	6.20±0.98	5.98±0.83
Color	7.89±0.73	8.36±0.55
Texture	7.38±0.73	7.25±0.71
Flavour	6.01±0.83	6.03±0.83
Apperance	8.25±0.58	8.35±0.49

Sample A = Tart cherry and whey
Sample B = Tart cherry, whey and green tea extract

Above results shows that taste, colour and appearance are statically significant whereas texture and flavour are not. ($p<0.05$)
The mean acceptability score of taste is high in sample A 6.20±0.98, and low in sample B 5.98±0.83
The mean acceptability score of colour is high in sample A 7.89±0.73. and low in sample B 8.36±0.55
The mean acceptability score of appearance is low in sample A 8.25±0.58, and high in sample B 8.35±0.49

Analytical Results
The total flavonoid content of the developed recovery drink without the addition of green tea extract had low antioxidant activity.
The product developed with the addition of 10% of green tea extract shows highest antioxidant activity.

Table 2: Total flavonoid content of developed drink mg/100ml

Sr. No.	Name of samples	Total flavanoid containt (mg/100ml)
1	A	229 mg
2	B	239 mg

The table 2 shows an increase in flavonoid content of recovery drink with the addition of green tea extract

Table 3: Pressure pain thresh hold mean

No of Days	Pain thresh hold	Group	
		Control	Pomegranate group
Day 1	No	20	21
	Slightly	10	9
Day 2	No	12	3
	Slightly	6	12
	Mild	6	6
	Moderate	3	9
	Severe	3	0
Day 3	No	1	0
	Slightly	0	0
	Mild	1	3
	Moderate	19	12
	Severe	9	15
Day 4	Mild	5	6
	Moderate	10	12
	Severe	15	12
Day 5	Slightly	0	3
	Mild	15	18
	Moderate	12	9
	Severe	3	0
Day 6	No	0	3
	Slightly	9	21
	Mild	21	6
	Moderate	0	0
Day 7	No	18	18
	Slightly	6	12
	Mild	6	0

By the end of seventh day slight or no pain was observed among the groups who consumed recovery drink, in control group mild pain was observed. On day one there was no significant difference 0.95seen since DOMS was not set. On day second and third p value is 0.001; significant difference was observed because the level of pain starts to rise up since DOMS starts to set.
Studies have shown the effect of tart cherry juice supplementation on strength and soreness after eccentric exercise. Maximal isometric elbow flexion and knee extension strength and muscle soreness measurements were made at baseline and 2, 24, 48, 72, 96, and 168 hours post exercise. Elbow flexion strength was significantly higher during the 2-to 168-hour period post exercise with tart cherry juice compared with that of placebo (main treatment effect; $p = 0.031$). Elbow flexor muscle soreness was also significantly reduced with tart cherry juice compared with that of placebo (main treatment effect; $p = 0.006$) and at 48 and 72 hours post exercise.
The present study was conducted on amateur gymers. The gymers were provided with recovery drink made of Tart cherries and whey to produce delayed onset muscle soreness, the subjects performed 3 sets of 20 unilateral eccentric elbow flexion and 6 sets of 10 unilateral eccentric knee extension exercises. Maximal isometric elbow flexion and knee extension strength and muscle soreness measurements were made at baseline and 1, 2, 3, 4, 5, and 7 days post exercise. Elbow flexion strength was significantly higher during the 2-5 day period post exercise with recovery drink compared with that of control. There was a significant recovery observed in the group 2 within five days post exercise. By fifth, sixth and seventh day the pain threshold was (0.006) which implies that recovery was observed.

Conclusion
The study was conducted to develop an antioxidant based recovery drink for the recovery of DOMS in amateur gymers and to determine its pressure pain threshold using VAS.
The research was based on the studies showing relationship between antioxidants, anti-inflammatory activity and muscles. In this study an antioxidants based whey drink was developed for the recovery of DOMS and micro-injuries in healthy person. The anti-oxidants from green tea extract were flavonoid which further mainly acts as a potent intracellular antioxidant. Fruits and green tea being rich source of antioxidants. Therefore the present study was undertaken to develop an antioxidant based recovery drink with the incorporation of whey, tart cherry juice and green tea. Control group showed slow recovery in comparison to Test group.
Thus it can be concluded that the developed recovery drink can be used for the recovery of DOMS post exercise. Further studies on other antioxidant rich natural produce can be undertaken to authenticate the claims made in the present study

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