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**Are tart cherry supplements effective on reducing muscle soreness
and perception of pain in young, healthy males following high
intensity resistance training?**

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A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies
Philadelphia College of Osteopathic Medicine
Philadelphia, Pennsylvania

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ABSTRACT

OBJECTIVE: The objective of this selective EBM review is to determine whether or not tart cherry supplements are effective at alleviating muscle soreness and pain following high resistance training.

STUDY DESIGN: Review of two double blind randomized control trials, and one crossover randomized control trial. All three studies were published in English between 2006-2015.

DATA SOURCES: Two double blind randomized control trials and one crossover randomized control trial found using Cochrane and PubMed.

OUTCOMES MEASURED: The outcomes measured were muscle soreness and perception of pain. They were measured using a pressure-pain threshold and 10 point pain scale

RESULTS: The first study, the Bowtell study showed tart cherry may provide a small amount of relief as assessed through pressure-pain threshold, but has not proven in this study to be statistically significant. The second study, the Connolly study indicate tart cherry supplements significantly aid in subjective measures of pain but not tenderness. The third study, the Levers study revealed overall, the tart cherry supplement significantly decreased participants perception of muscle soreness. No serious adverse events were noted in any of the three studies.

CONCLUSIONS: Based on these three trials, it is inconclusive whether tart cherry supplements are an effective treatment for musculoskeletal pain and soreness following high intensity resistance training. Not all results were statistically significant; however, each study showed some improvement in muscle soreness and perception of pain. Therefore, though more research is needed, tart cherry supplements may provide an alternative to or supplement to the use of non-steroidal anti-inflammatories.

KEY WORDS: Tart cherry, Montmorency cherry, pain, soreness

INTRODUCTION

High intensity resistance training involves working a muscle or muscle group to the point of fatigue in order to elicit physiologic changes such as hypertrophy and strength. These changes are essentially muscle strains which lead to pain and soreness, commonly referred to as delayed onset muscle soreness (DOMS).¹ Musculoskeletal (MSK) strain, whether training or trauma induced, leads to an oxidative stress response cascade with subsequent muscle damage and inflammation.² This paper evaluates three randomized control trials (RCT's) evaluating the efficacy of tart cherry supplements on muscle pain and soreness as an alternative to standard treatments for MSK pain.

The astonishing burden of MSK pain on the healthcare system warrants investigation into the treatment and handling of such a large percentage of the population. MSK pain in general, affects over 50% of adults 18 and older with a resultant 216 billion lost days of work, and an overall decreased quality of life.³ The annual expenditure for treating MSK conditions is 176.1 billion dollars⁴ and is second only to the economic burden of cardiovascular disease.⁵ MSK injury accounts for 77% of all healthcare injury visits.⁴ It is essential that healthcare providers understand the basis for such pain, as well as gain insight to the multitude of treatment options available. This includes more alternative and potentially safer, non-traditional methods such as tart cherry supplementations.

The physiologic basis for MSK pain is driven by mechanical, thermal and most notably, chemical stimulation of afferent pain receptors.¹ Chemical stimulation of receptors is led by the accumulation of inflammatory byproducts, mainly free radicals and prostaglandins (PGs).² Any accumulation whether acute or chronic, results in pain and/or soreness which may be mild or severe enough to affect daily living.^{1,2}

Traditional treatment of MSK pain includes non pharmacological treatments like physical and psychosocial modifications; however, pharmacological interventions prevail as the mainstay treatment. Pharmacological interventions vary in route of administration, availability, and receptor activity. Most commonly used are the COX-1 and COX-2 receptor inhibitors known as non-steroidal anti-inflammatories (NSAIDs), because their effects are well documented. These COX receptors are present in platelets, gastric mucosa, endothelium, and joints. NSAIDs block the action of PGs at COX-1 and COX-2 receptors thus eliminating or alleviating pain reception. Unfortunately the inhibition of COX receptors, though effective at reducing pain, results in adverse gastrointestinal, cardiovascular, cerebrovascular, renal, and hepatic effects.⁶

Controversy over chronic NSAID use and its potentially detrimental effects has pushed for more holistic health solutions. More recently, phytochemical containing foods such as purple sweet potatoes, beet root juice, cranberries, blueberries, and tart cherry (Montmorency cherry) have been considered for their potential anti-inflammatory (PGs) and anti-oxidant (free radical) properties.² Tart cherries have been found to contain phytochemicals such as anthocyanins which have proposed anti-inflammatory and anti-oxidant properties. It is proposed that these chemical work at the COX receptor in a similar manner to traditional NSAIDs, indicating Tart cherries may have similar effects when ingested.^{7,8}

OBJECTIVE

The objective of this selective EBM review is to determine whether or not tart cherry supplements are effective at alleviating muscle soreness and pain.

METHODS

The three studies chosen for this review all included the participant population of young healthy males over the age of 18, with muscle pain and soreness due to high intensity resistance

training. The intervention for all three studies were tart cherry supplements in the form of capsules or juice. The comparison made for all three studies was between participants who ingested a tart cherry supplement and participants who ingested a placebo supplement. The tart cherry supplements included 30 mL of Montmorency cherry juice, 12 oz of a Montmorency cherry and apple juice blend, and 480 mg of a powdered tart cherry capsule. Ingestion of these supplements ranged respectively from once in the morning and once in the evening for 10 or 8 days in the case of the juices, or 7 days prior to, the day of, and 2 days after training for 10 days in the case of the capsule. Placebos for the supplements included a synthetically derived fruit concentrate, unsweetened black cherry Kool-Aid, or rice powder capsules respectively. The anthocyanin content for the three studies ranged from $9.117 \text{ mg} \cdot \text{mL}^{-1}$ ⁷ to 40 mg .^{2,8} Outcomes measured throughout all three studies were muscle soreness and perception of pain. Two of the studies were double blind RCT's and the remaining was a crossover RCT. All three studies evaluated the efficacy of tart cherry supplements in reducing participant perception of pain and soreness following high intensity resistance training.

Key words used to search for articles included: tart cherry, Montmorency cherry, pain, and soreness. Articles were retrieved through Cochrane and PubMed, and selected based on relevance to the clinical question and inclusion of patient oriented outcomes (POEM). The articles were all published in English in Sports Medicine and Nutrition journals. Inclusion criteria for article selection required RCT's published in the last 10 years with a non-pharmacological placebo. Article exclusion criteria were studies with participants < 18 years of age, chronic pain conditions, or long term pain control medication use. Statistics for data analysis were reported using p values. Table 1 contains the demographics and characteristics of the included studies.

Table 1—Demographics & Characteristics of included studies

Study	Type	# Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Bowtell ⁶ (2011)	Double blind RCT	10	27.8 ± 1.6 yrs	<ul style="list-style-type: none"> • Competed in high-intensity intermittent sports • Regularly performed resistance training 	<ul style="list-style-type: none"> • Cardiorespiratory problems • Neuromuscular problems • Acute knee/ankle injuries and pain 	0	30-mL of Montmorency cherry juice concentrate
Connolly ⁷ (2006)	Crossover RCT	16	22 ± 4 yrs	<ul style="list-style-type: none"> • No elbow flexor pain • No upper extremity strength training in the past three months • No history of elbow or shoulder injury • No anti-inflammatory or pain relieving drugs during the study • No other treatment for any symptoms of muscle damage • No upper extremity exercise during the study 	<ul style="list-style-type: none"> • Exclusion criteria not specifically reported by authors but implied by the wording of their inclusion criteria • See Connolly Inclusion Criteria 	2	12 oz tart cherry juice blend
Levers ⁴ (2015)	Double blind RCT	23	20.9 ± 2.6 yrs	<ul style="list-style-type: none"> • Involved in a progressive resistance training program with regular squat exercises for at least 6 months prior to study recruitment • Able to perform a standard barbell back squat in a Smith machine rack of at least 1.5 times their body weight 	<ul style="list-style-type: none"> • Metabolic disorders-controlled or uncontrolled • History of hypertension, hepatorenal, musculoskeletal, autoimmune, and/or neurological disease(s) • Allergy to cherries or any cherry components (e.g. polyphenols, anthocyanins, anthocyanidins) 	0	480 mg powdered tart cherry supplement

OUTCOMES MEASURED

In Bowtell et al, the outcomes measured were pressure-pain threshold (PPT) assessed by a hand-held algometer on the muscle belly of the rectus femoris, vastus medialis, and vastus lateralis.⁷ In Connolly et al, the outcomes measured were pain and tenderness/soreness. These outcomes were measured using a 10-point pain scale and a manual myometer with threshold to tenderness.⁸ In Levers et al, the outcome measured was muscle soreness, it was assessed using a hand-held algometer.²

RESULTS

The results from all three studies compared the effects of tart cherry supplements versus a placebo treatment. Two were RCT's and one was a crossover RCT. All three studies had participant populations of males >18 years of age. Results were reported as p values with statistical significance set at $p \leq 0.05$. No adverse effects were noted.

In the Bowtell study, data were analyzed using a two-way repeated measures ANOVA. The comparisons were treatment (Montmorency cherry or placebo) versus time (pre-exercise, post-exercise, recover day one, and recovery day two). Data analysis revealed no statistically significant effect of trial or trial by time interaction. Results are displayed in Table 2. The results of this study indicate that there was no effect on PPT with the consumption of Montmorency cherry.⁷

Table 2. Average Quadriceps Pressure Pain Threshold (PPT) as Percent from Baseline⁷

	Pre-Exercise	Post-Exercise	24 hours Post Exercise	48 hours Post Exercise
Tart Cherry	100%	≈ 105 %*	≈ 85.0 %*	≈ 80.0 %*
Placebo	100%	≈ 99.0 %*	≈ 80.0 %*	≈ 70.0 %*

Table 2. *Values presented are estimates based on bar graph data presentation in the original article. Authors did not report exact numbers. PPT had a statistically significant decrease ($P < 0.001$) following exercise intervention for both trials. There was no statistically significant difference in trial or trial by time interaction ($P > 0.05$).

In the Connolly study, data were also analyzed using a two-way repeated measures ANOVA. The comparisons were treatment (tart cherry or placebo) versus time (baseline, 24, 48, 72, and 96 hours).⁸ Results revealed a statistically significant time by treatment interaction, $P = 0.017$. It was also noted that pain perception for the tart cherry trial peaked at 24 hours and then declined; whereas, the reported pain in the placebo trial continued to rise and then peak at 48 hours. Analysis did not reveal statistical significance in average pain when comparing trials, $P = 0.051$. Results are displayed in Table 3. Muscle tenderness was not found to be statistically significant ($P = 0.81$) between the tart cherry and placebo when comparing treatment by time. Comparison of mean tenderness between the two trials was also not statistically significant, $P = 0.84$.⁸ Results are displayed in Table 4.

Table 3. Average Pain Values Based on 10 point Scale⁸

	Baseline	24 hours	48 hours	72 hours	96 hours
Tart Cherry	0	≈ 3.5*	≈ 3.0*	≈ 2.0*	≈ 1.0*
Placebo	0	≈ 4.0*	≈ 4.5*	≈ 3.0*	≈ 1.5*

Table 3. *Values presented are estimates based on graph data presentation in the original article. Authors did not report exact numbers. There was no statistically significant difference in average pain amongst trials ($P=0.051$). There was a significant time by treatment interaction ($P=0.017$).

Table 4. Average Biceps Brachii Muscle Tenderness Reported in Newtons⁸

	Baseline	24 hours	48 hours	72 hours	96 hours
Tart Cherry	0	12*	13*	7.5*	5.5*
Placebo	0	10*	11*	7.0*	3.5 *

Table 4. *Values presented are estimates based on graph data presentation in the original article. Authors did not report exact numbers. There was no statistically significant difference in average tenderness amongst trials ($P=0.84$). There was no statistical significance for time by treatment interaction ($P=0.81$).

In the Levers study, data were analyzed using a repeated measures MANOVA. The comparisons were between group (tart cherry or placebo) and time (pre-lift, 60 minutes post, 24 hours post, and 48 hours post). Data analysis revealed no statistically significant difference for group by time, $P = 0.20$. It was noted that regardless of trial, muscle soreness increased over time with a peak at 48 hours. The group by time interaction for the vastus lateralis perceived soreness

was statistically significant from pre-lift values ($P=0.024$). There was also a statistically significant decrease in muscle soreness in the vastus medialis and lateralis for the tart cherry trial after 24 hours ($P < 0.05$). The vastus medialis also had a statistically significant decrease in muscle soreness after 48 hours ($P < 0.05$).² Results for comparison of quadriceps muscles soreness perception are displayed in Table 5.

Table 5. Average Quadriceps Muscle Soreness Perception in Newtons²

	Pre-lift	60 minutes Post	24 hours Post	48 hours Post
Vastus Medialis ¼ *				
Tart Cherry	3.80±2.86	3.59±2.76	5.50±2.68	5.99±3.59
Placebo	4.34±2.52	5.53±3.15	7.78±2.93	7.94±2.92
Vastus Lateralis ¼*				
Tart Cherry	2.98±2.70	4.03±2.93	4.76±3.03	6.07±3.67
Placebo	2.44±1.60	3.76±2.24	6.60±2.99	6.20±3.64
Vastus Lateralis ½*				
Tart Cherry	2.68±2.67	3.76±3.18	4.89±3.87	5.64±3.74
Placebo	3.25±2.65	3.42±3.24	6.55±3.80	6.18±3.36

Table 5. *Denotes distance along the muscle belly. Group by time interaction for the vastus lateralis group was statistically significant from pre-lift values ($P=0.024$). There was also a statistically significant decrease in muscle soreness in the vastus medialis ¼ and lateralis ¼ for the tart cherry trial at 24 hours ($P < 0.05$). The vastus medialis ¼ also had a statistically significant decrease in muscle soreness at 48 hours ($P < 0.05$).

DISCUSSION

Over 50% of adults 18 years and older are affected by MSK pain.³ The prevalence of this pain has shed light on the need for alternative therapy.² Traditional treatment with NSAIDs has made apparent the abundance of adverse side effects,⁶ justifying investigation into more natural solutions. It should be noted that the term “natural” does not always inherently indicate without risk. Tart cherry has been credited with a multitude of healing properties. These include alterations in metabolic syndrome, sleep, cancer, and most importantly antioxidant, analgesic, and anti-inflammatory changes.⁹ Tart cherries contain phytochemicals like anthocyanins which are proposed to hold anti-inflammatory and anti-oxidant properties. These chemicals, like traditional NSAIDs, work at COX receptors and may have similar effects when ingested.^{7,8}

The three studies analyzed in this review have revealed contradicting data as to the effects of tart cherry supplements when compared to placebos. In both the Connolly and Levers studies, authors were able to support tart cherry supplements for relief of pain and soreness respectively.^{2,8} The Bowtell study was not able to support the effects of tart cherry supplements on muscle soreness; however, trial comparison was close to statistical significance ($P=0.051$).⁷ This points out the important factor of sample size. Perhaps with a larger sample size, significance would have been achieved.

Additionally, previous research should not be ignored. Studies by Bell et al¹⁰, Howatson et al¹¹, and Kuehl et al¹² support the efficacy of tart cherry supplements in reducing oxidative stress and inflammation. These aforementioned studies differ from the ones analyzed in this review in the types of exercise performance (i.e. cycling, marathon running, and long distance relay running), which activate slightly different oxidative pathways than that of high intensity resistance training.^{10,11,12} Furthermore, the Bell et al and Howatson et al studies, objectively assessed oxidative stress and inflammation through blood testing.^{10,11} The study by Kuehl et al subjectively assessed pain through a visual analog scale.¹² The articles used in this review used a combination of both objective and subjective (POEM) assessments.

The limitations with the three studies analyzed in this review include the small sample size, short length of treatment time, and the type of exercise performed. A strength is most certainly the use of objective and subjective (POEM) outcome measures.

CONCLUSION

Based on this systematic review, it is inconclusive whether tart cherry supplements are effective treatment for MSK pain and soreness following high intensity resistance training. There were no adverse side effects noted in any of the studies. Therefore, providers may recommend

tart cherry supplements as additional treatment for MSK pain and soreness; however, providers should discuss that based on current research, the effectiveness is inconclusive. The data in these three studies are consistent with the equally inconclusive results of previous research on the topic. Suggestions for future research include: more participants for a longer length of treatment time, the inclusion of females, and perhaps variety in the exercise performed (i.e. different groups based on the participants preferred type of physical activity). Regardless, the findings from this review and previous research warrant further investigation into the effects of tart cherry supplements on muscle pain and soreness.

REFERENCES

1. Kedlaya D. Postexercise Muscle Soreness: Overview, Etiology, Histologic Findings. 2016. Available at: <http://emedicine.medscape.com/article/313267-overview>. Accessed November 10, 2016.
2. Levers K, Dalton R, Galvan E, et al. Effects of powdered montmorency tart cherry supplementation on an acute bout of intense lower body strength exercise in resistance trained males. *Journal of the International Society of Sports Nutrition JID - 101234168*. 1120.
3. Watkins-Castillo S, Yelin E, Weinstein S. The Big Picture. *BMUS: The Burden of Musculoskeletal Diseases in the United States*. 2016. Available at: <http://www.boneandjointburden.org/2014-report/i0/big-picture>. Accessed October 8, 2016.
4. Watkins-Castillo S, Yelin E, Weinstein S. By The Numbers: Musculoskeletal Injuries. 2016. Available at: <http://www.boneandjointburden.org/docs/By%20The%20Numbers%20-%20MSK%20Injuries.pdf>. Accessed October 8, 2016.
5. Fact Sheets – IASP. 2016. Available at: <http://www.iasp-pain.org/Advocacy/Content.aspx?ItemNumber=1101>. Accessed October 8, 2016.
6. Atchinson J, Herndon C, Rusie E. NSAIDs for Musculoskeletal Pain Management: Current Perspectives and Novel Strategies to Improve Safety. 2016. Available at: <http://www.amcp.org/WorkArea/DownloadAsset.aspx?id=17383>. Accessed October 8, 2016.
7. Bowtell JL, Summers DP, Dyer AF, Fox P, and Mileva KN. Montmorency cherry juice reduces muscle damage caused by intensive strength exercise. *Medicine and science in sports and exercise JID - 8005433*. 1129.
8. Connolly DAJ, McHugh MP, Padilla Zakour OI. Efficacy of a tart cherry juice blend in preventing the symptoms of muscle damage. *British Journal of Sports Medicine*. 2006;40(8):679-683. doi:10.1136/bjism.2005.025429.
9. Tart Cherries Summary Of Current Scientific Literature. 1st ed. Portland: National University of Natural Medicine; 2016. Available at: <http://nunm.edu/images/Helfgott/Projects/scientific-literature-summary-cherries-2011.pdf>. Accessed December 3, 2016.
10. Bell PG, Walshe IH, Davison GW, Stevenson E, Howatson G. Montmorency Cherries Reduce the Oxidative Stress and Inflammatory Responses to Repeated Days High-Intensity Stochastic Cycling. *Nutrients*. 2014; 6(2):829-843.

11. Howatson G, McHugh MP, Hill JA, Brouner J, Jewell AP, Van Someren KA, Shave RE and Howatson SA. Influence of tart cherry juice on indices of recovery following marathon running. 2010. *Scandinavian Journal of Medicine & Science in Sports*, 20: 843–852. doi:10.1111/j.1600-0838.2009.01005.x
12. Kuehl KS, Perrier ET, Elliot DL, Chesnutt JC. Efficacy of tart cherry juice in reducing muscle pain during running: a randomized controlled trial. *Journal of the International Society of Sports Nutrition*. 2010;7:17. doi:10.1186/1550-2783-7-17.