

Impact case study (REF3)

Institution: University of Northumbria at Newcastle		
Unit of Assessment: 24 (Sport and Exercise Sciences, Leisure and Tourism)		
Title of case study: Improved recovery of elite athletes through nutritional interventions containing tart Montmorency cherries		
Period when the underpinning research was undertaken: 2010 – 2018		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Glyn Howatson	Professor	01/09/2009 - present
Karen Keane	Senior Lecturer	01/08/2013 - 2020
Emma Stevenson	Reader	01/10/2006 - 2015
Ian Walshe	Senior Lecturer	29/09/2008 - present
Period when the claimed impact occurred: August 2013 - July 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact (indicative maximum 100 words)		
<p>Recovery from strenuous exercise is a priority for elite athletes. Northumbria University's research into tart Montmorency cherries (TMC) showed that these functional foods facilitate athletic recovery and improve sleep. Through the delivery of practitioner professional development, the research shaped the [text removed for publication] nutritional guidelines used by all 22 performance nutritionists working with over 500 Olympic and Paralympic athletes. Professional international sports organisations [text removed for publication] now routinely use TMC supplementation and attribute performance success to effective recovery enabled by the intervention during congested competition periods. Following the widespread change in nutritional practices in the UK and internationally, Northumbria's research was incorporated into the International Olympic Committee (IOC) <i>Consensus Statement on Dietary Supplements and the High-Performance Athlete</i>, changing elite sports' nutritional guidance worldwide.</p>		
2. Underpinning research (indicative maximum 500 words)		
<p>In recent years, elite sports across the world have become increasingly interested in how to facilitate exercise recovery without the use of invasive or pharmacological interventions during times of intensified training, rehabilitation, and competitions. As specialists in the field of exercise stress and recovery, Northumbria's <i>Optimising Human Performance</i> group led by Professor Glyn Howatson systematically investigated whether, and how, 'functional foods' (foods that provide health benefits beyond the provision of essential nutrients) such as tart Montmorency cherry (TMC) juice could be used in athletic recovery [R1–R6]. This research was conducted by Northumbria University in collaboration with the [text removed for publication], as well as with industrial partners: CherryActive Ltd (rebranded Active Edge Nutrition Ltd in 2017) and Cherry Marketing Institute (USA).</p> <p>The first applied human study to examine the influence of TMC juice supplement on muscle function, inflammation and oxidative stress variables after strenuous exercise was developed, led and executed by Howatson during the 2008 London Marathon (in collaboration with the Nicholas Institute of Sports Medicine and Athletic Trauma in New York, and others) [R1]. In this blinded, randomised, placebo-controlled trial, data showed a 10% improvement in the recovery of muscle function with TMC juice consumption in recreational athletes. This improvement was accompanied by reduced inflammation (~50%) and oxidative stress indices in the days following the marathon.</p>		

Since this initial study, a series of blinded, randomised, placebo-controlled trials have been conducted in relation to sport-specific paradigms, including high intensity cycling experienced by professional road cyclists [R2, R3] and repeated sprint sports such as rugby and football [R4]. The research team also examined the acceleration of recovery from exercise-induced muscle damage in female athletes [R5]. Controlled laboratory environments were necessary as the effectiveness of TMC juice in a free-living environment (such as the London Marathon study) was more challenging to observe, due to confounding uncontrolled extrinsic factors. This approach allowed the research team to further assess TMC juice supplementation as an intervention to influence recovery. Collectively, the studies showed an unequivocal return of muscle function and reductions of post-exercise inflammation, substantiating TMC's use in a range of sporting contexts and across sexes. These studies were all conceived and executed at Northumbria University; collaborating colleagues from other institutions (such as Dr Gareth Davison, University of Ulster) provided specialist analytic skills for bespoke measures such as oxidative stress.

An adjunct research strand, in collaboration with Professor Jason Ellis (UoA 4), focused on whether consumption of TMC juice enhanced sleep [R6]. TMC contain high levels of many phytochemicals that include melatonin, a molecule critical in regulating the sleep-wake cycle in humans. Professional athletes frequently suffer from disturbed sleep, which is further magnified when travelling to training camps and competitions where the added stressor from jetlag can increase sleep disturbance. This Northumbria-led interdisciplinary collaboration, with the University of Surrey and the Nicholas Institute of Sports Medicine and Athletic Trauma, USA, demonstrated that total melatonin content was elevated in participants that were given TMC; these volunteers also demonstrated increased total sleep time by 35 minutes and increased sleep efficiency total by ~6% in comparison to the placebo control [R6].

3. References to the research (indicative maximum of six references)

R1. Glyn Howatson, McHugh, M.P., Hill, J., Brouner, J., Jewell, A., van Someren, K.A., Shave, R., and Howatson, S.A. (2010) 'The effects of a tart cherry juice supplement on muscle damage, inflammation, oxidative stress and recovery following marathon running' *Scandinavian Journal of Medicine and Science in Sports* **20**: 843-852 <https://doi.org/10.1111/j.1600-0838.2009.01005.x>

R2. *Bell, P.B., Ian Walshe, Davison, G.W., **Emma Stevenson**, and **Glyn Howatson** (2014) 'Inflammation and oxidative stress are attenuated following repeated days strenuous metabolic activity following cherry juice consumption' *Nutrients* **6**: 829-843 <https://doi.org/10.3390/nu6020829>

R3. *Bell, P.B., Ian Walshe, Davison, G.W., **Emma Stevenson**, and **Glyn Howatson** (2015) 'Recovery facilitation with Montmorency cherries following high-intensity, metabolically challenging exercise' *Applied Physiology Nutrition and Metabolism* **40**: 414-423 <https://doi.org/10.1139/apnm-2014-0244>

R4. *Bell, P.B., Emma Stevenson, Davison, G.W., and **Glyn Howatson** (2016) 'The effects of Montmorency tart cherry concentrate supplementation on recovery following prolonged, intermittent exercise' *Nutrients* **8**: E441 <https://doi.org/10.3390/nu8070441>

R5. Brown, M.A., Emma Stevenson, and **Glyn Howatson** (2018) 'Montmorency tart cherry (Prunus cerasus L.) supplementation accelerates recovery from exercise-induced muscle damage in females' *European Journal of Sport Science* **19** (1): 95-102 <https://doi.org/10.1080/17461391.2018.1502360>

R6. Glyn Howatson, *Bell, P.G., Tallent, J., Middleton, B., McHugh, M.P., and *Ellis, J. (2012) 'Effect of tart cherry juice (Prunus cerasus) on melatonin levels and enhanced sleep quality' *European Journal of Nutrition* **51**: 909-916 <https://doi.org/10.1007/s00394-011-0263-7>

*Internal collaborators: J. Ellis - Professor in Psychology, P.G. Bell - Northumbria University Strategic Innovation Funded doctoral student (2010 -2015),

Research funding:

Cherry Marketing Institute: total funding 2013-2020 GBP89,723
 Cherry Active: total funding 2010-2020 GBP61,130
 Cherry Research Committee: 2012-2013 GBP13,500

4. Details of the impact (indicative maximum 750 words)

4.1 Change of nutritional practices in the [text removed for publication] and benefits to athletes

[text removed for publication] Through formal collaboration [E1] with the [text removed for publication], Northumbria's research findings were shared with practitioners via bespoke workshops and continuing professional development events. The [text removed for publication] network of 22 performance nutritionists work with 40 sports, collectively supporting >500 elite athletes. In 2015, TMC supplements produced by CherryActive were included as [text removed for publication] approved nutritional interventions [E2], recommended due to their recovery and anti-inflammatory properties [R1–R5] and the associated improvements in sleep [R6]. As a result, TMC is routinely recommended and provided [text removed for publication] to support athlete success. This change in nutritional practice directly affected athletes who used the intervention during training camps, periods of congested competition, and in rehabilitation. Feedback from nutritionists and athletes demonstrated that TMC mitigated the negative effects of strenuous exercise (loss of function and inflammation). For example, an independent study, citing Northumbria's research into oxidative stress, used CherryActive's supplement in the successful recovery programme of an overtrained elite British athlete [E3, p3]. Lack of sleep associated with time zone travel is a common concern for athletes taking flights for training and competitions. During the 2019 Olympic test events in Japan, [text removed for publication] squads were offered the use of TMC juice; 20 used TMC, with 75% reporting some positive results and/or confirming they will use it in preparation for the Tokyo Olympic Games [E4].

4.2 Policy impact: TMC in international and national nutrition guidelines

TMC were not used as a recovery intervention prior to 2010 [R1]. Northumbria's research demonstrated that TMC interventions are safe and effective in facilitating recovery. This led to their inclusion in two prominent documents demonstrating a change in nutritional policy at UK and international levels.

The 'International Olympic Committee (IOC) Consensus Statement on Dietary Supplements and the High-Performance Athlete' [E5] is an open-access, guidance document, designed to inform athletes and practitioners on current best practice, that has been widely cited by a global audience (>350 citations across Europe, Asia, Australasia and the Americas - Google Scholar). In 2018, directly referencing Northumbria's research, it listed TMC as a supplement assisting with training capacity, recovery, muscle soreness and injury management. It states it may be beneficial for exercise recovery as '*[TMC juice] decreases in inflammatory cytokines and/or indirect markers of muscle damage...[its] anti-inflammatory effect may be beneficial, although benefits may be sport/training specific*' [E5, Table 5].

In 2016, the British Association of Sport and Exercise Sciences (BASES), the UK's largest professional association for sport and exercise sciences, published the 'Expert Statement on Elite Athlete Recovery'. The statement included the use of TMC as one of just seven recovery strategies available to elite athletes [E6, p4] and is circulated to all BASES members in the UK and abroad (>1000).

4.3 Impact on recovery within professional sports: UK and internationally

As a result of Northumbria's research, professional sports' nutritional teams in the UK and internationally (Australia, European countries, New Zealand, USA) have changed their practice to incorporate TMC interventions to support successful recovery programmes.

[text removed for publication] are examples of UK teams competing internationally:

- [text removed for publication] 'As a direct consequence of the research from Professor Howatson's laboratory... in times of congested competition periods [text removed for publication] when recovery is absolutely critical, we use tart Montmorency cherries as an integral part of the recovery regimen... As a result, we have seen an improvement in the recovery profiles of the players and importantly players believe this to be of benefit to their recovery' [E7].
- [text removed for publication] led and implemented the team's nutrition strategy [text removed for publication] stated 'As a consequence of this research [from Northumbria University] I now educate our athletes and prescribe the use of tart cherries routinely to facilitate improvements in recovery. [text removed for publication] we use tart cherries as part of our recovery strategy by consuming both before and after every stage. Many athletes have been using the tart cherry juice in some of the highest profile competitions in the world and have reported a positive effect on their recovery' [E8].

Giving a multi-sport international example, [text removed for publication] stated 'I can confirm our integration into practice the research conducted by Dr Glyn Howatson and his colleagues at Northumbria University in phytochemicals (specifically the use of tart cherry). [This research has been applied] in training, and/or competition in sports such as Athletics, Canoeing, Rugby and winter sports at the elite level. It was incorporated into the training programmes and strategies used by [text removed for publication] in the lead up to and during the...2018 Commonwealth Games held in Australia, and 2016 Olympic and Paralympic Games' [E9].

4.4 Commercial impact on a supplier of cherry supplements

The increased consumption of TMC by professional (and recreational) athletes led to Cherry Active Ltd, supplier of nutritional supplements, securing its market position as a result of global reporting of Northumbria's research and its recommendation in [text removed for publication] resources [E2]. The demand for TMC ensured a consistent stream of business for this small to medium-sized enterprise, which supplies England Rugby, Premier League Football, Cricket, professional Tennis, and Olympic teams (Athletics, Cycling, Rowing, and Hockey). Commenting on the company's expanded professional sports client base, Director John Carey stated '[Northumbria's publications] in the leading journals in their field help build referrals from health and sports nutritionists. This has helped us win business from world-class athletes and teams looking for a competitive edge from their training and nutrition choices. [This resulted in] [text removed for publication] in extra sale revenue over the past six years' [E10].

5. Sources to corroborate the impact (indicative maximum of 10 references)

Ref.	Source of corroboration	Link to claimed impact
E1	Document: Memorandum of Understanding	[text removed for publication]
E2	[text removed for publication]	[text removed for publication]
E3	Independent to Northumbria research publication/ case study "Alterations in Redox Homeostasis During Recovery from Unexplained Underperformance Syndrome in an Elite International Rower"	Confirms the effectiveness of TMC in recovery and describes how the intervention has been used in an over-trained athlete to facilitate recovery. Corroborates widespread use of TMC in routine practice

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E4	Document: Feedback from [text removed for publication] during Olympic training event in Japan	The spreadsheet includes athletes' feedback (men and women's [text removed for publication] squads) on using TMC during the Olympic test event in Japan. Corroborates better sleep among athletes
E5	Document: International Olympic Committee Consensus Statements on Dietary Supplements and the High-Performance Athlete	Corroborates impact on international nutritional policy in elite sport
E6	Document: The BASES Expert Statement on Athletic Recovery Strategies (June 2016)	Corroborates impact on national nutritional policy in elite sport
E7	Testimonial - [text removed for publication]	Corroborates change in practice among elite nutritionists in the UK
E8	Testimonial - [text removed for publication]	Corroborates TMC use for recovery among athletes, with positive feedback
E9	Testimonial - [text removed for publication]	Corroborates change in practice among elite nutritionists in [text removed for publication]
E10	Testimonial - John Carey, Director of the Active Edge Nutrition Ltd (formerly CherryActive)	Describes spikes in sales after UNN publications in national media about TMC. States economic impact on the company