Institution: University of Chichester

Unit of Assessment: 24: Sport and Exercise Sciences, Leisure and Tourism

Title of case study: New Zealand Blackcurrant Supplementation: Creating International Demand and Contributing to Product Development and Sector Growth

Period when the underpinning research was undertaken: 2012-present

Details of staff conducting the underpinning research from the submitting unit:

Names:	Roles:	Periods employed by submitting HEI:
1. Professor Mark Willems 2. Professor Stephen Myers 3. Dr Mandy Gault 4. Dr Sam Blacker	1. Professor of Exercise Physiology 2. Professor of Exercise Physiology 3. Senior Lecturer in Exercise Physiology 4. Reader in Exercise Physiology and Nutrition	1. 2003-to-date 2. 2008-to-date 3. 2012-to-date 4. 2013-to-date

Period when the claimed impact occurred: 2015-present

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact

Research at the University of Chichester (UoC) provided evidence of the meaningful benefits of New Zealand (anthocyanin-rich) blackcurrant consumption on human physiology, exercise performance, exercise metabolism and health. This led to 5 substantial benefits to the international sports nutrition and blackcurrant industries:

1) Informing the development of new products, supporting sports nutrition businesses
2) Changing practices and guidance provided by 3 national high-performance multi-sports organisations (Australian Institute of Sport, English Institute of Sport, High Performance Sport New Zealand)
3) Enhancing demand for blackcurrant supplements across a range of sports, and within the general public
4) Disseminating blackcurrant research to national and international blackcurrant associations (representing blackcurrant growers and processors)
5) Increasing consumer awareness of the benefits of blackcurrant supplementation

2. Underpinning research

Since 2015, the University of Chichester (UoC) has undertaken the first ever systematic programme of sports and exercise nutrition research to examine the potential impacts of New Zealand (anthocyanin-rich) blackcurrant supplementation in athletic and non-athletic populations. Building on prior research in epidemiology, which evidenced the various health benefits of anthocyanin-rich foods, this work has now delivered novel and robust evidence of the diverse benefits of anthocyanin-rich blackcurrant supplementation.

The first study in this programme of research examined the effects of blackcurrants on common exercise physiology parameters. It provided an essential observation: the intake of anthocyanin-rich blackcurrant powder for 7 days lowered exercise intensity-related blood lactate during intermittent incremental exercise **[R1]**. The effects of blackcurrant powder supplementation on substrate metabolism were found to be similar to those of long-term endurance exercise training,

highlighting the potential of anthocyanin-rich supplementation to affect human physiology, postpone fatigue and enhance exercise performance. An industry-funded (c. GBP11,000) study **[R2]** showed a 2.4% endurance-enhancing effect on a cycling time trial following the intake of an anthocyanin-rich blackcurrant extract. In line with this result, additional follow-up exercise performance studies conducted by the UoC researchers (intermittent high-intensity running, sprint running, and sports climbing) have also demonstrated blackcurrants' performance-enhancing effects.

In order to inform the dosing strategy for the intake of anthocyanin-rich blackcurrant in sport and exercise, our research has also considered dose and duration effects. We observed dose effects on 2-hour cycling-induced metabolic responses as exemplified by whole-body fat oxidation **[R3]** and cardiovascular function at rest **[R4]**. This research showed that there was an impressive 21.5% increase of whole-body fat oxidation in endurance-trained males after 2 hours of cycling – a finding that was confirmed in a further collaborative (Liverpool John Moores-based) study with endurance-trained females **[R5]**. Additional UoC studies have shown intake duration effects for walking-induced fat oxidation, alongside evidence for the necessity of daily intake. Taken together, these findings reveal the potential of anthocyanin-rich blackcurrant to affect exercise-induced metabolic responses, with exciting implications for athletic performance enhancement, as well as health and weight management issues within the general public.

Beyond whole-body fat oxidation, our research has shown how blackcurrants can positively affect a large range of human physiological parameters. These include effects on fasting insulin and glucose handling, increased femoral artery diameter **[R6]**, enhanced muscle oxygenation, reduced emission of skin volatile organic compounds associated with body odour in older adults (researched in collaboration with Tokai University, Japan), and reduced blood pressure in older adults (researched in collaboration with Nippon Sport Science University, Japan). These findings demonstrate the profound relevance of anthocyanin-rich blackcurrant for preventive medicine, health promotion and well-being.

With a body of research encompassing over 20 peer-reviewed scientific papers since 2014 (14 in SJR Q1/Q2 journals; h-index of 9 (236 citations)), the UoC has been instrumental in leading and disseminating research on the applications of anthocyanin-rich blackcurrant extract and powder in human exercise and health physiology.

3. References to the research

Peer-reviewed journal articles

R1. Willems, M. E. T, Myers, S. D., Gault, M. L., & Cook, M. D. (2015). Beneficial physiological effects with blackcurrant intake in endurance athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, 25(4), 367–374. https://doi.org/10.1123/ijsnem.2014-0233.

R2. Cook, M. D., Myers, S. D., Blacker, S. D., & Willems, M. E. T. (2015). New Zealand blackcurrant extract improves cycling performance and fat oxidation in cyclists. *European Journal of Applied Physiology*, 115(11), 2357–2365. https://doi.org/10.1007/s00421-015-3215-8.

R3. Cook, M. D., Myers, S. D., Gault, M. L., Edwards, V. C., & Willems, M. E. T. (2017). Dose effects of New Zealand blackcurrant on substrate oxidation and physiological responses during prolonged cycling. *European Journal of Applied Physiology*, 117(6), 1207–1216. https://doi.org/10.1007/s00421-017-3607-z.

- Funded (c. GBP11,000) by Health Currancy Ltd (UK).

R4. Cook, M. D., Myers, S. D., Gault, M. L., Edwards, V. C., & Willems, M. E. T. (2017). Cardiovascular function during supine rest in endurance-trained males with New Zealand blackcurrant: a dose-response study. *European Journal of Applied Physiology*, 117(2), 247–254. https://doi.org/10.1007/s00421-016-3512-x.

R5. Strauss, J. A., Willems, M. E. T., & Shepherd, S. O. (2018). New Zealand blackcurrant extract enhances fat oxidation during prolonged cycling in endurance-trained females. *European Journal of Applied Physiology*, 118(6), 1265–1272. https://doi.org/10.1007/s00421-018-3858-3.

R6. Cook, M. D., Myers, S. D., Gault, M. L., & Willems, M. E.T. (2017). Blackcurrant alters physiological responses and femoral artery diameter during sustained isometric contraction. *Nutrients*, 9(6), 556. https://doi.org/10.3390/nu9060556.

The research cited above is novel research and has been published in Q1/Q2 SJR rated peer-reviewed scientific journals. ***All outputs are available on request.***

4. Details of the impact

1) Informing the development of new products, supporting sports nutrition businesses

Our research has informed and supported the development of a variety of commercial products, some of which have earned prestigious international awards. In some cases, our research has also been cited as a key factor underpinning these successes. Health Currancy Ltd, the primary supplier of New Zealand blackcurrant extract worldwide, states that: 'These studies have gained international attention, recognition and multiple prestigious awards, including the Nutra Ingredients Asia Sports Nutrition Product of the Year award 2020 **[C1]**, and two European Specialist Sports Nutrition (ESSN) Awards – Best Post-Workout (winner) and Sports Nutrition Product of the Year (Highly Commended) in 2020 **[C2]**. The ESSN judges made notable mention of the "strong science-backed evaluation" behind the product, and feedback at Nutra Ingredients stated: "Extensive research, good traction and even greater scope for future growth were admired by the judges."' **[C2]**. New businesses have also started, including 2before, Epoch Nutrition, Black Max Nutrition, Pure Sports Nutrition, and Aiora – which refer to our research findings in their advertising materials **[**e.g., **C3]**.

2) Changing practices and guidance provided by 3 national high-performance multi-sports organisations: Australian Institute of Sport (AIS), English Institute of Sport (EIS), High Performance Sport New Zealand (HPSNZ)

In 2019, the AIS listed blackcurrant in its supplement B-category for the first time. The then AIS Chief of Nutrition Strategy and Head of Sports Nutrition confirmed that Willems's research (UoC) had been critical to this decision: 'His work on the anthocyanins in blackcurrants has been seminal in providing insights that have guided us to place blackcurrants/extracts on the Group B (Deserving of further research) in our Framework' **[C4]**. This has been mirrored in the UK, with the EIS also deciding to use blackcurrant supplementation based on UoC's research. In a published interview Dr Nathan Lewis, Lead Performance Nutrition Scientist at the EIS, stated: 'The University of Chichester research showing the effect of CurraNZ on performance in cyclists and triathletes got me really excited, showing comparable increases with some other ergogenic aids […] The science on CurraNZ is robust and it offers clear benefits for endurance and recovery - there's a big role for CurraNZ to play.' Lewis also testifies to the real-world benefits of blackcurrant supplementation, stating that 'At the EIS we have observed CurraNZ to be effective in reducing inflammation in athletes undergoing heavy training who aren't recovering as we would like.' **[C5]**.

Similar interest in the performance-enhancing effects of blackcurrant was also shown by HPSNZ, which provided funding in 2019 for a visit by Willems to New Zealand. During this visit, Willems disseminated findings to nutritionists, coaches and trainers working with nationally and internationally competing athletes. The HPSNZ Performance Nutrition Technical Lead highlighted the changes to practice that were made within the organisation following this visit: 'This has directly led to the modification and refinements of the nutrition and clinical practice of the practitioners in the Performance Nutrition team at HPSNZ.' As a result of the visit, Health Currancy Ltd became the preferred supplier to HPSNZ **[C6]**.

3) Enhancing demand for blackcurrant supplements

Health Currancy Ltd has reported an increased demand as a direct result of the UoC's research findings. Fleur Cushman, Managing Director at Health Currancy Ltd (UK), stated that 'Professor

Willems' research has been a driver for the development of the NZ blackcurrant functional food industry, with growers now ensuring specific varieties of blackcurrant are being planted to cope with anticipated international demand for its expanding health and sports nutrition markets in the coming years.' Cushman also notes that extensive media coverage of the UoC's research has led to CurraNZ becoming a best-selling sports nutrition product on Amazon UK, and its use by a host of internationally leading athletes: 'Pleasingly, some of the world's most recognisable athletes and sporting teams, including World No 1s and record-holders across a range of sports, have incorporated CurraNZ into their nutrition strategies. CurraNZ is a trusted supplier to several national sporting bodies and is now being implemented by teams in the high-performance market in the US and EU countries.' **[C7]**.

4) Supporting national and international blackcurrant associations (representing blackcurrant growers and processors)

Willems was an invited speaker at the 2017-19 International Blackcurrant Association (IBA) conferences, which are attended primarily by blackcurrant stakeholders. The IBA President Jens Holme Pederson confirmed that 'We feel that the research by Professor Mark Willems and colleagues has increased global awareness among blackcurrant growers, processors and business what this berry has to offer' **[C8]**. Similarly, the Chair of Blackcurrant NZ Inc. (New Zealand's blackcurrant industry representative body) stated that 'the research by the University of Chichester has been of great support and value to the New Zealand blackcurrant industry' **[C9]**. UoC research findings related to the benefits of blackcurrant supplementation are on its website. Midori Echigoya, General Manager of the Japan Blackcurrant Association, noted that Willems's 'open and collaborative approach to research [has created] positive relationships with all stakeholders' **[C10]**.

5) Increasing consumer awareness of the benefits of blackcurrant supplementation

Our research has led to significant media coverage. A select review of this coverage reveals that between 2015 and 2020 alone it has featured in at least 36 online articles, from outlets including the *Mirror*, the *Express* and the *Daily Mail*, achieving a global reach of 51,193,006 people and an advertising value equivalent to GBP486,620. Our research also received UK TV coverage, including in *Superfoods – The Real Story* (Channel 4, 2015), with a reach of 1,750,000 people **[C11]**.

5. Sources to corroborate the impact

C1. Nutra Ingredients Asia Awards, 'Previous Winners': https://www.nutraingredientsasia-awards.com/live/en/page/previous-winners.
C2. European Specialist Sports Nutrition Awards 'Winners': https://www.essnawards.com/shortlist/.
C3. Epoch Nutrition, 'Performance & Recovery – New Zealand Blackcurrant Extract Capsules: https://epochnutrition.co.nz/products/performance-and-recovery.
C4. Testimonial statement from Professor Louise Burke, former Head of Sports Nutrition at the Australian Institute of Sport.
C5. Testimonial statement from Dr Nathan Lewis, Lead Performance Nutrition Scientist at the English Institute of Sport: www.whichtrainingcamp.com/nutrition/item/curranz-offers-effective-recovery-strategies.
C6. Testimonial statement from Jeni Pearce, High Performance Sport New Zealand Nutrition Technical Lead
- High Performance Sport New Zealand 'Commercial Partners' list: https://hpsnz.org.nz/about-us/commercial-partners/.

C7. Testimonial statement from Fleur Cushman, Managing Director of Health Currancy Ltd (UK).
C8. Testimonial statement from Jens Holme Pederson, President of the International Blackcurrant Association.
C9. Testimonial statement from James Tavendale, Chair of Blackcurrant New Zealand Inc.

C10. Testimonial statement from Midori Echigoya, General Manager of the Japanese Blackcurrant Association.
C11. UoC Specialist Press Report: blackcurrant research media coverage.