

# PhD Opportunity

An exploration of responders and non-responders to New Zealand blackcurrant intake on metabolic and cardiovascular responses

**Director of Studies:** Dr Matthew Cook

**Research Group:** [Human Performance Research Group](#)

## The PhD Opportunity

Use of dietary supplements as ergogenic aids is common among athletes to support training and enhance performance (Maughan et al 2011). Recent research has examined effects of non-traditional ergogenic aids such as blackcurrant due to both exercise and health effects. Blackcurrant contains a high and specific content of the polyphenol anthocyanins (Kähkönen et al 2003), considered to be the essential bioactive berry compounds.

Intake of New Zealand blackcurrant (NZBC) has been shown to alter resting cardiovascular function by increasing cardiac output (Willems et al 2015; Cook et al 2017) and improve cycling (Cook et al 2015) and repeated high intensity running performance (Perkins et al 2015). All these responses were observed in young healthy males and could have resulted from alterations in blood flow by blackcurrant. For example, Matsumoto et al (2005) observed oxygenated haemoglobin in the trapezius to be higher with 2-weeks intake of blackcurrant compared to a placebo during 30-minutes of typing. In addition, during a maximal voluntary contraction (MVC) of the trapezius performed 3-minutes following the typing, total haemoglobin was also higher. Furthermore, Cook et al (2017b) observed a 7-day intake of NZBC increased femoral artery diameter during a submaximal 120-second isometric contraction of the knee extensors, with a concomitant decrease in systolic, diastolic and mean arterial blood pressure. Further observations demonstrate that the increased femoral artery diameter during the isometric contraction following NZBC is dependent upon intake duration, with no change from 1-day, but an increase following 4 and 7-days (Cook et al. 2021).

All these studies have followed the traditional, randomised, double-blind, placebo-controlled design employed within sports nutrition research. However, this approach only compares participants following one intake of blackcurrant and placebo. This design does not investigate if those participants that demonstrate a positive effect (performance, cardiovascular, metabolic etc) respond consistently. For example, in the study by Cook et al (2015), 11 of 14 participants demonstrated a performance improvement while Perkins et al (2015) demonstrated performance improvements in 10 of 13 participants. For a supplement to be used and trusted within sports nutrition, athletes would regularly consume the supplement and need to know if the expected results can be achieved every time.

Additional effects following NZBC intake has included increased fat oxidation during exercise (Cook et al 2015; Cook et al 2017; Strauss et al 2018; Hiles et al 2020; Şahin et al. 2021; Şahin et al. 2022; Willems et al. 2022; Shan and Cook 2023). The underlying mechanisms for this observation are not known, and again the consistency of responders or non-responders has not been examined. The ability to determine factors that will lead to individuals who respond or do not respond is important for recommendations to athletes consuming NZBC.

This PhD will investigate the interindividual factors that could predict responders or non-responders to New Zealand Blackcurrant intake. It will involve laboratory data collection within a series of studies that are likely to be experimental designs that are randomised, double blind and placebo controlled. The individual variation in exercise performance and physiological responses will likely be examined through repeated testing sessions, to examine repeatability of responses. Ideally, participants will be experienced cyclists and runners and have a moderate to high level of training. They will be recruited from local cycling and running clubs and the community.

### References

- Cook MD, Dunne A, Bosworth M, Willems MET (2023). Effect of Intake Duration of Anthocyanin-Rich New Zealand Blackcurrant Extract on Cardiovascular Responses and Femoral Artery Diameter during Sustained Submaximal Isometric Contraction. *J Diet Suppl*, 20(1):15-27. doi: 10.1080/19390211.2021.1948943.
- Cook MD, Myers SD, Blacker SD, Willems ME (2015). New Zealand blackcurrant extract improves cycling performance and fat oxidation in cyclists. *Eur J Appl Physiol*, 115(11):2357-65. doi: 10.1007/s00421-015-3215-8.
- Cook MD, Myers SD, Gault ML, Edwards VC, Willems MET (2017). Dose effects of New Zealand blackcurrant on substrate oxidation and physiological responses during prolonged cycling. *Eur J Appl Physiol*, 117(6):1207-1216. doi: 10.1007/s00421-017-3607-z.
- Cook MD, Myers SD, Gault ML, Willems MET (2017). Blackcurrant Alters Physiological Responses and Femoral Artery Diameter during Sustained Isometric Contraction. *Nutrients*, 29;9(6):556. doi: 10.3390/nu9060556.
- Hiles AM, Flood TR, Lee BJ, Wheeler LEV, Costello R, Walker EF, Ashdown KM, Kuennen MR, Willems MET (2020). Dietary supplementation with New Zealand blackcurrant extract enhances fat oxidation during submaximal exercise in the heat. *J Sci Med Sport*, 23(10):908-912. doi: 10.1016/j.jsams.2020.02.017.
- Kähkönen, MP, Heinämäki J, Ollilainen V, Heinonen M. (2003). Berry anthocyanins: isolation, identification and antioxidant activities. *J. Sci. Food Agric*, 83: 1403-1411. doi.org/10.1002/jsfa.1511
- Matsumoto H, Takenami E, Iwasaki-Kurashige K, Osada T, Katsumura T, Hamaoka T (2005). Effects of blackcurrant anthocyanin intake on peripheral muscle circulation during typing work in humans. *Eur J Appl Physiol*, 94(1-2):36-45. doi: 10.1007/s00421-004-1279-y.
- Maughan RJ, Greenhaff PL, Hespel P (2011). Dietary supplements for athletes: emerging trends and recurring themes. *J Sports Sci*, 29 Suppl 1:S57-66. doi: 10.1080/02640414.2011.587446.

Perkins IC, Vine SA, Blacker SD, Willems ME (2015). New Zealand Blackcurrant Extract Improves High-Intensity Intermittent Running. *Int J Sport Nutr Exerc Metab*, 25(5):487-93. doi: 10.1123/ijsnem.2015-0020.

Şahin PhD MA, Bilgiç PhD P, Montanari MSc S, Willems PhD MET (2022). Daily and Not Every-Other-Day Intake of Anthocyanin-Rich New Zealand Blackcurrant Extract Alters Substrate Oxidation during Moderate-Intensity Walking in Adult Males. *J Diet Suppl*, 19(1):49-61. doi: 10.1080/19390211.2020.1841356.

Şahin PhD MA, Bilgiç PhD P, Montanari MSc S, Willems PhD MET (2021). Intake Duration of Anthocyanin-Rich New Zealand Blackcurrant Extract Affects Metabolic Responses during Moderate Intensity Walking Exercise in Adult Males. *J Diet Suppl*, 18(4):406-417. doi: 10.1080/19390211.2020.1783421.

Shan Y, Cook MD (2023). New Zealand Blackcurrant Increases Postexercise Hypotension Following Sustained Moderate-Intensity Exercise. *Int J Sport Nutr Exerc Metab*, 6;33(5):282-290. doi: 10.1123/ijsnem.2023-0014.

Strauss JA, Willems MET, Shepherd SO (2018). New Zealand blackcurrant extract enhances fat oxidation during prolonged cycling in endurance-trained females. *Eur J Appl Physiol*, 118(6):1265-1272. doi: 10.1007/s00421-018-3858-3.

Willems MET, Banic M, Cadden R, Barnett L (2022). Enhanced Walking-Induced Fat Oxidation by New Zealand Blackcurrant Extract Is Body Composition-Dependent in Recreationally Active Adult Females. *Nutrients*, 1;14(7):1475. doi:10.3390/nu14071475

### **Application Process**

To begin the application process please go to

<https://www.worc.ac.uk/research/research-degrees/applying-for-a-phd/>.

### **The Interview**

All successful applicants will be offered an interview with the proposed Supervisory Team. You will be contacted by a member of the Doctoral School Team to find a suitable date. Interviews can be conducted in person or over Microsoft Teams.

### **Funding your PhD**

For information about Doctoral Loans please visit: <https://www.worc.ac.uk/study/fees-and-finance/doctoral-loans.aspx>

During your PhD you can access the Research Conference Support Scheme to support the costs of presenting your research at an external conference.

### **Research at the University of Worcester**

Research is central to the University's mission to make a difference in everything that we do. We are committed to delivering excellent research which extends the boundaries of human knowledge but which also improves people's lives by enabling better health outcomes, improving food security, developing environmentally sustainable solutions for crop production and socially sustainable solutions to our ageing population, enhancing public knowledge and understanding of the past and present.

The University hence focuses its research around five high-level challenges facing society, locally, nationally and globally:

- [Human Health and Wellbeing](#)
- [Sustainable Futures](#)
- [Digital Innovation](#)
- [Culture, Identity and Social Exclusion](#)
- [Professional Education](#)

The success of our research is reflected in our continuous improvement in external research assessment processes. In the most recent Research Excellence Framework, REF 2021, the University saw a near 50% increase in the scale of its research and 12% increase in quality, building on its performance in REF 2014 when it was the UK's most improved university in terms of Research Power, a combination of scale and quality.

### **Research Degrees at Worcester**

Our research students are central to our overall mission for research. They are working at the cutting edge of their disciplines and driving forward the quality of our research whilst enriching our research culture. We are looking to increase our research student numbers as a strategic imperative.

Our commitment to our students is reflected in the results of the Postgraduate Research Experience Survey 2023 in which we ranked 3<sup>rd</sup> for overall research student satisfaction nationally. Key to our success in this area is the Doctoral School, a focal point for all our research students.

It provides:

- day-to-day support for our students, both administrative and practical, through our dedicated team
- a Research Student Study Space with both PCs and laptop docking station
- a comprehensive Researcher Development Programme for students and their supervisors
- a programme of student-led conferences and seminars

### **Widening Participation**

As part of its mission statement the University is committed to widening participation for its higher degrees. Although most candidates will have an undergraduate and/or a Masters degree, the University is happy to accept applications from candidates with relevant professional qualifications and work related experience.

**For further information or an informal discussion on this project, please contact Dr Matthew Cook ([matthew.cook@worc.ac.uk](mailto:matthew.cook@worc.ac.uk))**