

## Impact case study (REF3)

<b>Institution:</b> University of Greenwich		
<b>Unit of Assessment:</b> 3 - Allied Health Professions, Dentistry, Nursing and Pharmacy		
<b>Title of case study:</b> Impact of research on nutrition products, and injury reduction and recovery protocols for high performance athletes on the financial performance and strategy of international sports-product companies in the UK, Europe and South America		
<b>Period when the underpinning research was undertaken:</b> January 2012 – July 2020		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b>	<b>Role(s) (e.g. job title):</b>	<b>Period(s) employed by submitting HEI:</b>
Fernando Naclerio Ayllon	Associate Professor	04/07/11 – present
Marcos Seijo Bujia	Lecturer	29/09/14 – present
Mark Goss-Sampson	Associate Professor	01/09/93 – present
Birthe Nielsen	Principal Lecturer	24/09/07 – present
Tatiana Christides	Senior Lecturer	01/01/09 – 31/07/18
Bettina Karsten	Senior Lecturer	01/10/02 – 31/07/18
<b>Period when the claimed impact occurred:</b> January 2014 – July 2020		
<b>Is this case study continued from a case study submitted in 2014?</b> N		
<b>1. Summary of the impact</b>		
<p>Ensuring professional and amateur athletes remain healthy and fit is important for their careers and their long-term wellbeing. Applied research by the UoG team, in collaboration with sports and health companies, has had significant international impact on the development of nutrition products and the commercialization of injury reduction and recovery protocols. The team has worked in partnership with the <b>Spanish</b> company <b>Crown Sports Nutrition</b> to design new products, improve product performance, and change product strategy; with <b>Argentinian</b> company <b>Inertial Power SRL</b> to substantially increase interest in product demand and credibility of their products; and with the UK company <b>ARC Microtech</b> to help them change strategy and expand their customer base from clinical groups to athletes with corresponding increases in revenue. These companies' products all aim to improve the performance and health of their customers, which include renowned national and international athletes, football and basketball teams.</p>		
<b>2. Underpinning research</b>		
<p>The recently created <b>Centre for Exercise, Activity and Rehabilitation</b>, led by <b>Naclerio</b> at the <b>Institute for Lifecourse Development</b>, was created to support and further develop our long-standing expertise in research and practice in this area. The UoG team has been integrating their research with the strategies of several sports health and technology businesses over many years, impacting directly on companies' efficiency, productivity, and sales. <b>Naclerio, Christides, Goss-Sampson, Karsten, Nielsen</b> and <b>Seijo</b> have widespread expertise in the effects of exercise and nutrition strategies on performance, injury prevention and body composition in physically active individuals. Below, we outline three lines of research that were undertaken in partnership with companies from three different areas of the sports market who obtained significant benefits from supporting and being supported by science.</p>		
<b><u>Research on nutrition to improve performance and health of athletes</u></b>		
<p>In February 2014 the CEO of the sports supplements company <b>Crown Sport Nutrition</b> contacted the team, expressing their interest in conducting high-quality research to test the effect of their nutrition products in athletes. A collaborative agreement was signed between both institutions to conduct sports nutrition based-research to investigate the effects of ingesting protein-based admixture supplementation. This research resulted in increased knowledge of the biochemical and</p>		

physiological pathways through which certain nutritional strategies can favour athletic performance and health. Results showed that protein supplementation significantly improved exercise training outcomes in terms of strength and endurance, muscle mass gain, and fat reduction, as well as overall markers of health including immune status and iron status [3.1, 3.2, 3.3, 3.4].

#### **Research on the use of flywheel machine protocols to reduce injury in athletes**

In 2012, the CEO of **Inertial Power SRL** attended one of the keynote presentations delivered by **Naclerio** for the National University of La Plata, Argentina. Thereafter the company contacted **Naclerio** expressing their willingness to sponsor the MSc Strength and Conditioning and provide equipment for conducting research projects at the University of Greenwich. Research investigated the effect of using flywheel machines, produced by the company Inertial Power SRL, on injury markers (e.g., strength and valgus) in recreationally trained athletes [3.5]. Results showed that isoinertial flywheel technology confers protective adaptations from hamstring strain and anterior cruciate ligament injuries and enhances the capacity of repeated sprints, which is essential in team sports such as football, rugby or hockey. The UoG team proposed a novel injury prevention programme with flywheel devices. Compared to a traditional programme, the new flywheel-based protocol showed improvement in risk injury markers and increased athletes' performance. The ease of integration of the relatively brief proposed protocol with other training modalities gathered the attention of coaches looking for more time effective training methodology compared to the current traditional recommended protocols such as FIFA-11 for footballers.

#### **Research on the use of micro-currents to speed recovery in athletes**

In April 2017, the company **ARC Microtech Ltd** contacted the UoG asking for support in testing the effectiveness of microcurrent stimulation in athletes. **Naclerio** led this UoG research consultancy agreement and the UoG team studied the effectiveness of the **Arc4Sports electrical device**, made by ARC Microtech Ltd, to optimise muscle remodelling and speed up recovery after exercise [3.6]. The device sends a small, undetectable current through muscles, consisting of a complex pulsed waveform with a fundamental frequency of 1.0309 kHz along with a variety of current intensities between 50 and 400  $\mu$ A. Previous studies proved the ability of microcurrent to promote tissue healing after injury, but no research has analysed whether this could be effective in promoting adaptations on healthy (non-injured) physically active individuals. Research led by **Naclerio** determined the effects of wearing a new commercially available microcurrent device combined with different exercise modalities on body composition, recovery, and general markers of health and immune function in physically active people, including athletes. Two interventional studies, using parallel group double blind randomised controlled pre post intervention designs have been completed (ClinicalTrials.gov ID: NCT03477747). The two conducted studies, combining the microcurrent devices with resistance or endurance training, demonstrated benefits of the microcurrent to reduce Delayed Onset Muscle Soreness, to obtain additional benefits of muscular structure (thickness) and to speed up recovery after exercise.

### **3. References to the research**

1. **Naclerio F**, Larumbe-Zabala E, Ashrafi N, **Seijo M**, **Nielsen B**, Allgrove J, Earnest PC. Effects of protein–carbohydrate supplementation on immunity and resistance training outcomes: a double-blind, randomized, controlled clinical trial. *European Journal of Applied Physiology*. 2017; 117(2):267-277. [10.1007/s00421-016-3520-x](https://doi.org/10.1007/s00421-016-3520-x). [REF2 Submission – Identifier 16147]
2. **Naclerio F**, **Seijo M**, Larumbe-Zabala E, Ashrafi N, **Christides T**, **Karsten B**, **Nielsen, B**. Effects of Supplementation with Beef or Whey Protein Versus Carbohydrate in Master Triathletes. *Journal of American College of Nutrition*. 2017;36(8):593-601. doi:[10.1080/07315724.2017.1335248](https://doi.org/10.1080/07315724.2017.1335248).
3. **Naclerio F**, Larumbe-Zabala E, Cooper K, **Seijo M**. Effects of a Multi-ingredient Beverage on Recovery of Contractile Properties, Performance, and Muscle Soreness After Hard Resistance Training Sessions. *Journal of Strength and Conditioning Research*. 2020; 34(7):1884-1893. doi:[10.1519/JSC.0000000000003397](https://doi.org/10.1519/JSC.0000000000003397).

4. Monajati A, Larumbe-Zabala E, **Goss-Sampson M**, & **Naclerio F**. Injury prevention programs based on flywheel vs. body weight resistance in recreational athletes. *The Journal of Strength & Conditioning Research*. 2021 Feb 1;35(Suppl 1):S188-S196. doi: [10.1519/JSC.0000000000002878](https://doi.org/10.1519/JSC.0000000000002878). Please note there was an Epub ahead of print published 28 September 2018, and the accepted paper was publicly shared in 2018 via addition to the university repository: <https://gala.gre.ac.uk/id/eprint/21802/>; that the paper was thus effectively shared prior to Dec 2020 is further indicated by its citation in, e.g., a paper published in April 2019 in the European Journal of Sport Science by different authors (<https://doi.org/10.1080/17461391.2019.1588920>).
5. **Naclerio F**, **Seijo M**, Karsten B, Brooker G, Carbone L, Thirkell J, Larumbe-Zabala E. Effectiveness of combining microcurrent with resistance training in trained males. *European Journal of Applied Physiology*. 2019;119(11):2641-2643. doi:[10.1007/s00421-019-04243-1](https://doi.org/10.1007/s00421-019-04243-1).
6. **Naclerio F**, Moreno-Pérez D, **Seijo M**, Karsten B, Larrosa M, Garcia-Merino JA, Thirkell, J, Larumbe-Zabala E. Effects of Adding Post-Workout Microcurrent in Males Cross Country Athletes. *European Journal of Sports Science*. 2020; 1-23. Doi: [10.1080/17461391.2020.1862305](https://doi.org/10.1080/17461391.2020.1862305).

#### Indicators of research quality:

- All but one reference has been published in international **peer-reviewed academic journals**, indicating an overall international quality or above.

#### 4. Details of the impact

The research outlined above has impacted directly on the companies with which the team has worked: though innovation in the design of new products; improvement of product performance; change in strategy; and new revenue. The companies furthermore benefitted from improved reputation, credibility, and visibility due to their research collaborations with **Naclerio** and coworkers. In all cases, given the nature of the products, athletes and physically active people will derive long term benefits in terms of their health and wellbeing and their sports performance.

#### **Contribution to innovation, improvement of performance, and change in strategy for Crown Sports Nutrition**

**Crown Sports Nutrition** is a Spanish company for sports supplements that collaborates with many Spanish federations, elite athletes, teams and organisations. As outlined above, Crown Sports Nutrition worked closely with **Naclerio** on research on products to optimise exercise-induced effects [5.1]. The results formed an essential component of the efforts of the company to develop evidence-based effective products [5.1]. Results from the investigations of the University of Greenwich team have been used for the improvement and marketing of the company's products. On product development, we conducted several studies to investigate the effect of protein-based admixtures to speed up recovery and maximize training-induced outcomes in male and female participants. This was essential for improving the quality of products and providing evidence on their effects. The research allowed the company to formulate a post-workout admixture containing beef and whey protein. This product was demonstrated to be effective in improving recovery after resistance exercise in men. The promising results were also used to produce a similar product using only protein from vegetable sources that was also effective in improving recovery after strength training in young participants. Thus, these studies helped us to formulate new original and effective products for our clients. Two of the new products have been successfully commercialized: **Beef and Whey** and 3:1 **Pro Recovery**. The 3:1 Pro Recovery is currently the second most sold product of the Crown Sports Nutrition brand. Demand for the 3-1 Pro vastly increased due to marketing explicitly citing the results of **Naclerio's** research. The company developed two similar products using only vegetable-derived nutrients which have been recently tested by **Naclerio**, (i) postworkout (available in January 2021) and (ii) preworkout. The company used reports from **Naclerio** to introduce their products to potential customers (e.g., a football team, rugby team, Sports Federations and many fitness centres in Spain, Europe, and South America). Furthermore, **Naclerio** has performed consultancy work in presenting results to customers in Europe, the Middle East, South (Argentina and Uruguay) and Central America (Mexico), where institutions including the **Argentinian Football Association** and **Uruguayan**

**Football Association** have contacted **Naclerio** to receive more detailed information on the use of the investigated supplements. **Naclerio** helped the company to become widely considered as the most trustworthy and prestigious company within the Spanish Market and one of the most recognised in Europe and South America and worldwide [5.1]. This is reflected in already signed agreements in Lebanon, Qatar, Iraq, Mexico and the UK; and in growth - since the collaborative UoG consultancy agreement with **Naclerio** has started in 2014, Crown Sport Nutrition has repeatedly roughly doubled sales over a few years: around EUR120,000 in 2018, EUR240,000 in 2019, and more than EUR400,000 in 2020, and the company considers the research a key component of this growth as one of the most prestigious sports nutrition companies in Europe [5.1]. Based on the reports and papers by **Naclerio**, the results have been disseminated by the company to more than 10,000 sports nutritionists and athletes [5.1]. Their products are being currently consumed by athletes of different disciplines, including endurance sports (e.g., **Run Faster Better**) and Football (e.g., **Udinese Calcio, Italy**). The company believes that the wider use of these effective and improved products will have plausibly improved health and sports performance in the company's customers [5.1].

#### **Contribution to improvement of performance for Inertial Power SRL**

**Naclerio's** research providing scientific evidence on **Inertial Power SRL's** injury prevention protocol directly contributed to the company's reputation as one of the most prestigious suppliers of flywheel devices in the global market, thus improving performance of the company and ultimately contributing to increase in revenue [5.2]. The company disseminated the results of the research via strategies such as including posting to their website and direct communications to potential clients, and convincing professionals worldwide of the benefits of using the machines, including international sports clubs (e.g., **Argentinian, Brazil, Uruguay, Chile, Ecuador and Peru National football teams, Argentinian National Basketball team**) and national (e.g., **River Plate, Boca Juniors, Colon De Santa Fe, Gymnasia y Esgrima La Plata, Racing Club, Talleres de Cordoba, Belgrano de Cordoba, Rosario Central, Newells Old Boys, Peñarol de Uruguay, Olympia de Paraguay**) [5.2]. This increased the range of customers reached by the company and contributed to increases in sales of the studied products, by +27% in 2019 and +34% in 2020 (the yo-yo squat machine) and +19% in 2019 and +26% in 2020 (the Valkyria software trainer). Free provision of machines to the researcher enhanced their teaching capacity by being able to offer students the opportunity to study these devices. Coaches and therapists from the aforementioned institutions decided to purchase flywheel equipment manufactured by Inertial Power SRL based on the research conducted by **Naclerio** [5.2]. It is plausible that, given the nature of the protocol, customers benefitted from reduced injury and improved training results [5.2].

#### **Contribution to improvement of performance, change in strategy, and new revenue sources for ARC Microtech**

Finally, significant benefits were accrued by **ARC Microtech Ltd, Essex, UK**, via the expanded range of commercialization of their microstimulators. Previous microcurrent technology was often cumbersome, and ARC Microtech developed two remarkably small, pre-programmed, drug-free, and sophisticated microcurrent devices, which require just a simple one-touch operation, aiming to make this technology consumer friendly and more widely accessible. Both devices have received regulatory approval and are certified as Class 2a medical devices. The company initially only marketed the product for clinical interventions but after contacting **Naclerio** they decided to analyse the potential benefits for exercise programmes in athletes from different disciplines (strength and power or endurance). Results evidenced benefits of microcurrent in physical training by hastening recovery and improving muscle mass accretion in physically active people. The research provided awareness and information on these benefits that fed into the company's decision-making and has enabled the company to make business decisions and expand into the sports market, increasing sources of revenue. The company believes the research has enhanced their overall reputation, has made a useful contribution to regulatory auditing, and has in fact translated into increased sales [5.3]. The company believes it plausible that these impacts have ultimately provided benefits to their customers, via improved recovery and stronger training effects by using their products. Additional testimonials from users, including athletes, are available via the following link <https://arcmicrotech.com/arc4health/trustpilot-reviews/>. In addition, the free provision

**Impact case study (REF3)**

of devices to the researchers created educational opportunities for several UoG student research projects.

**5. Sources to corroborate the impact**

1. Testimonial from Crown Sports Nutrition.
2. Testimonial from Inertial Power SRC.
3. Testimonial from ARC Microtech Ltd.