New submission from ARC Award Final Report

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To: Scholarly Activity <scholarlyactivity@langara.ca>

Name of Researcher

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Department/Faculty

Kinesiology

Position in Department/Faculty

Faculty

Project Title

Resting Cardiovascular function and its Association with Athletic Performance Measures in Female Soccer Players.

Term of Project

Fall 2021-Summer 2022

Please introduce yourself – include pertinent background information relating to the topic of your research project.

My name is Brent Day and I have been an employee of the College since 2005. I started off in the athletics department as the Facilities Assistant where I was able to work with many of our student athletes and Kinesiology students. Shortly after I enrolled in a Masters program in Edith Cowan University in Perth Australia where I began my interest in sport science and athlete monitoring. My experience in Perth also involved working with Australian Football League athletes where data was being collected on force plates, velocity based training devices, heart rate monitors, speed gates, and cardiovascular field tests. This experience gave me the understanding and knowledge to apply these technologies in a sport setting. The week after I received my Masters degree, then department chair, Ajay Patel, hired me back to Langara to teach in the Kinesiology program. Being involved in the kinesiology program allowed me share these concepts with my students. After I became a regular faculty member, my colleague Andrew Perrotta and I started the applied human performance research team. We were able to secure some of the latest tech and perform regular physical assessments on the Langara Women's Soccer team. After a few testing session, my interest in integrating a physiological measure of fatigue with a neurological measure for fatigue. This is how my interest in heart rate variability and vertical jump started, and it lead to this research project.

Please discuss your educational background and your work experience that led you to taking on this research project. If possible, include a quote that helps define your interest in this project.

"Most sport coaches think that 'tired' is 'out of shape'. It takes a while to lose conditioning but you can fatigue a team in a few days." -Michael Boyle

This quote is one reason why I believe my research is important. Sport coaches often mistake fatigue for not being conditioned enough. So they end up pushing their athletes too hard. Coaches need to be educated on how simple measures that are valid and reliable can help guide them to push an athlete and when to scale back on load. I first learned this during my time in my Masters program working with AFL athletes. Strength and conditioning coaches worked closely with the teams sport scientists to determine when to increase and decrease load based on various physical test. HRV and vertical jump are two assessable test that can be performed regularly to help with load management.

Please summarize your project in plain language that others not in your field could understand.

This project looked at heart rate variability (cardiovascular assessment of the nervous system) scores and compared them to countermovement jump (muscular system assessment of nervous system) scores. The goal of the project was to show that these two variables could help determine what type of work you could put an athlete through based on these scores. HRV is the amount of time between each heart beat, typically we look at heart rate in beats per minute. But our heart doesn't beat like a metronome, there is variability between each beat. This variability can be measured using a heart rate monitor and determine if we are in a rest and digest state, or the fight or flight state. So it is measuring our stress level. If we get a high HRV score it means we are rested, which would be an ideal state for an athlete to train hard. If we are stressed, we get a low score, which means the athlete needs to rest or adjust training to have a lighter load.

The countermovement jump is an assessment of how high you can jump. It involves the athlete jumping with their hands placed on their hips to isolate the lower body movement. Typically if someone achieves a high vertical jump score above their average. their nervous system is highly active and communicating with the muscular system well. This indicates the athlete is ready for hard training. If their score is below their average they are suffering from fatigue and need a lighter load.

What we have found in our research is there is great variability between the two tests. We do not see high HRV scores associated with high CMJ scores or visa versa. This indicates that each test has value in helping determine what type of training should be prioritized. For example, if an athlete has a low HRV, indicating physiological stress. But has a high CMJ score, indicating neuromuscular activation. The coach may want to prioritize more muscular training like resistance training and give the athlete a rest from cardiovascular training.

Identify the project goals and objectives. Explain how the results may be used to solve a problem or inform further research in the field.

The project goals and objectives were to help coaches identify, using simple and fast assessments, a way to help manage training load and prioritize training. I believe our results have started a solid foundation for this group of subjects (collegiate women's soccer) to provide coaches a blueprint to monitor fatigue and manage their load. There is definitely further research that can be done in this area. One area I would like to explore is researching if there is a point where the two assessments meet in creating an ideal state for training and recovery.

Briefly explain the steps taken (methods used) to conduct the research, and describe the key findings.

METHODS: Seventeen healthy female collegiate soccer players with an age of (mean ± SD) 18.5 ± 0.75 yr, a weight of 57.3 ± 9.2 kg, a height of 165.4 ± 7.2 cm, and a body fat % of 23.2 ± 7.4 volunteered as participants. HRV was analyzed in the supine position after a 10-min stabilization period. R-R intervals were recorded over 60-seconds using the Polar Team Pro® chest strap and were exported into Kubios HRV 3.4 (University of Kuopio, Kuopio, Finland) for HRV analyses. Each participant performed three separate squat jumps, counter movement jumps and drop jumps with their hands placed on their hips. Jump performance was assessed using a force plate (Hawkin Dynamics Force Plate, ME, USA). The highest jump was included for each analysis. Normality of each data set was examined using a Shapiro-Wilk’s test for normality ($p > 0.05$). Linear regression ($R2$) was utilized to examine the association between rMSSD and both EUR and RSI. RESULTS: No significant associations were observed between rMSSD and both EUR ($R2 = 0.004$, $p = 0.74$) and RSI ($R2 = 0.001$, $p = 0.87$).

Who was involved in this project (eg. faculty, students, community partners)? How did their involvement contribute to the project’s success? Were there any challenges to overcome?

Andrew Perrotta and myself were the two faculty members involved in this study. We also had one Kinesiology student involved in this project as well, Rachel Barker. The testing was performed on the Langara Women's soccer team. Andrew's contribution was tremendous to this project. He was very helpful and supportive when it was time to collect

our data. Andrew collected the HRV data has it was his area of expertise. I collected the vertical jump data. Rachel help write the abstract and create the poster that was accepted by the American College of Sports Medicine to be presented at the annual conference. Rachel was put as the first author for this project.

Please share any personal stories that made this research experience memorable/valuable.

I think the most valuable part of this research experience was bringing a Kinesiology student to join the team and have her receive a first time author publication and poster accepted to a major sports science conference. When we were at the ACSM conference, most of the poster presenters were masters and PhD students, Rachel and the other student researchers from the applied human performance team were the only undergraduates presenting posters as authors. It was a great experience for 4 of our Langara students.

What are the next steps for this project and for you as a researcher?

The next step for this project is to apply for the Fall 2022 ARC to continue this Research. Ideally the next step is to do a longer study and collect HRV and vertical jump data for multiple days or weeks. We would like to see what the trend looks like on a more regular basis. I believe we will get more answers with long term data collection.

Please upload any images that will help to showcase your project.

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