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Body Composition Analysis

Dr. Claire Mills

Senior Lecturer, University of Gloucestershire



Shane Duff, who previously captained Cheltenham Town Football Club, was perched on a swing-like seat which was being lowered in to a well of water, deep inside an exercise laboratory at the University of Gloucestershire's Oxstalls campus. To the casual observer, the apparatus has the semblance of a medieval ducking stool, but Senior Lecturer Dr Claire Mills

reassures Shane that the painless process would only take a few minutes and is an essential part of the body composition analysis that she is undertaking.

Claire is using the hydrostatic weighing tank, to give it its full name, in order to measure Shane's whole body density. This is just one of the techniques that Claire uses in her work with the Cheltenham Town team to provide essential data on the body composition of the professional players. So just what is body composition? Claire, who undertook a PhD in the subject, explains more fully: "Body composition is not just about body fat, it is much more detailed than that. We can analyse levels and quantities of fat free mass, fat mass, body volume and body density. Unfortunately a lot of people are aware of the obesity epidemic and jump onto that bandwagon and think it is all about how much extra fat we are carrying. Commercial gyms regularly measure body fat levels through less accurate equipment and some that rely on electrical currents. For me, those measurements are absolutely flawed for an athlete because they do not take into account fat free mass or muscle. All you need to be doing is drinking a cup of tea or water and it will throw all the measurements out completely. With elite level athletes, I focus on their entire composition such as, body fat distribution, physique and how



they're structured, in terms of muscle and fat, by measuring the muscle girths, breadth and width of bones and the subcutaneous fat that they're carrying just under the surface of the skin. Claire explains how the technique of dunking in the hydrostatic tank can give her vital information about Shane's body composition. "With whole body density, muscle weighs heavier than fat so when you saw Shane in the tank he was actually sinking quite a lot because he's actually very muscular. Someone who has a greater level of body fat will have a tendency to float to the surface, so with this measurement I can determine how much they weigh under water and then calculate their whole body density."

The tank is one of the three key methods that Claire applies to create sound body composition analysis. The second is perhaps familiar to anyone who has signed up to a fitness analysis at a gym, although the methodology applied is far more detailed. "For anthropometric measurements, we take a measurement of body fat just under the surface of the skin with a skinfold caliper. We also use a measuring tape and anthropometer for muscle and bone girths, breadths, depths and widths,



that's taken throughout the body, explains Claire". Thirdly, the BodPod, weighing in at a hefty £35,000 is the latest piece of technology that Claire uses to make her measurements, using air displacement methods. "It uses a process identical to that of water displacement, where for example, you have a full bucket of water and once a brick or heavy object is put in, water overflows. The BodPod uses this method, but instead of water it determines the air that is displaced and then calculates body volume."

"I've worked with a wide range of elite athletes including tri-athletes, cyclists, gymnasts, kick boxers, hammer throwers and professional rugby clubs, but I have predominately work with professional football clubs.

These clubs come to the University of Gloucestershire to be tested in a range of fitness parameters. When I've compiled all the results I'll feedback all the results and give them a more in-depth analysis of each athlete/player. "It could be that we identify for example, six players that are carrying extra fat mass around the abdominal region and so the team's coaches/trainers will carry out extra strength and conditioning work to trim them up. Or it could be that they need to do a specific type of stretching to improve certain flexibility tests they're doing, so it all really depends on what we've identified. Most football clubs have sport science support these days, unfortunately body composition is often overlooked and in some instances, not seen by some as being an

area of importance".

Claire's research has a very practical application that can impact on the players' performance. For instance it can help to (i) quantify the important characteristics of body composition; (ii) diagnose players' strengths and weaknesses, (iii) customize training programmes for specific positions/roles within a team; (iv) track changes in a players body composition and (v) provide information about the health status of players. "With my research, I have collected data on over 300 FIFA registered contracted professional footballers, from eight football clubs that represented Barclays Premiership through to Blue Square Premier Leagues during three playing seasons. I like to think that I'm at the cutting edge of sport science research because previous football research has only focused on a squad or a range of 50-100 players. With my data, I developed new calibration models to estimate whole body density that will inevitably provide me with the best way to analyse professional footballers with more authority." And Shane's verdict after emerging from the hydrostatic tank? "I'd say that we're very lucky to have this facility local to us. The club is really, really grateful to Claire and the University for being able to use the facilities available."

