

Using science to catch a cheat

August 22 2012, By Lisa Aloisio



The truth is, doping in elite sports exists and with so much pressure to be the best, unfortunately some athletes turn to cheating. With the spotlight on the London Olympics and the recent doping scandal of the Tour de France it is evident that doping is still an issue that impacts on the integrity of the sports industry worldwide.

Manipulation of <u>urine</u> specimens by athletes to conceal drug use still occurs and poses an ongoing challenge for doping control laboratories around the world.

Two researchers from the UTS Centre for <u>Forensic Science</u> are at the forefront of efforts to unmask <u>chemical</u> manipulation of samples, receiving \$154,000 of Commonwealth Government funding this year to



continue an anti-doping research program started in 2010.

Dr Shanlin Fu and Dr Unnikrishnan Kuzhiumparambil started their work investigating the effects of a number of oxidizing chemicals on urinary steroid profiles, which are key indicators for monitoring anabolic <u>steroid</u> <u>abuse</u> and other banned or illegal substances in sports.

Many chemicals when added into urine specimens for doping control purposes are able to destroy or mask drugs of interest which means they can produce false negative urine test results. Dr Fu and Dr Kuzhiumparambil's initial research in 2010, aimed to improve the detection of prohibited substances after urinary manipulation by oxidizing chemicals. The methods used were primarily gas or <u>liquid</u> <u>chromatography</u> and mass spectrometry.

The 2010 research identified that many oxidising chemicals, including commonly available household chemicals, lead to significant changes in the endogenous steroid profile parameters considered stable under normal conditions. Oxidants such as nitrite, permanganate, hypochlorite, pyridinium chlorochromate, dichromate and peroxides were found to significantly reduce the endogenous steroid concentration levels and alter steroid ratios in samples.

"The 2010 project was to simply see if certain oxidizing chemicals, including some commercially available chemicals such as bleach, peroxide, chromate or nitrite, could change the natural structure of the native steroid profile of human urine," said Dr Fu.

"We selected 12 chemicals and tested what effects they would have on the natural urinary steroid profile. The selected chemicals were added to urine samples and we measured the levels of testosterone, epitestosterone and other steroid species in the urine and then compared that with the urine samples without the addition of the chemicals to see



the difference."

Results showed a large amount of the selected chemicals tested either changed, destroyed or lowered the <u>concentration levels</u> of the native steroid species in urine, ultimately allowing drug use to be disguised by various chemical masking agents.

Dr Fu explains, "We documented in detail exactly what each selected chemical did to a number of the native steroid species in urine. Some chemicals selectively targeted one or two steroid species and others destroyed the native steroid species globally, therefore altering the normal steroid ratio within human urine."

This year's funding will allow Dr Fu and Dr Kuzhiumparambil to extend on their 2010 research by observing what new species are being formed from the oxidizing chemicals' reactions in the urine samples.

"We've established that commonly available chemicals can potentially mask or manipulate the detection of drug abuse in urine samples. Obviously there is something new that has formed from this reaction and this is what we want to explore further."

Dr Fu refers to these new reaction products as "unique markers". Unique markers alter the structure of the native urinary steroid profile. For example after testosterone is exposed to certain oxidizing chemicals its natural composition is destroyed forming a new entity. This new entity may have an additional functional group attached to some part of the structure which means it would have a different molecular make up.

Dr Fu and Dr Kuzhiumparambil want to now identify these new molecules manipulating the normal steroid structure and develop a list that can be incorporated into the anti-doping routine drug testing laboratories. This would allow unique markers to be detected within a



test which would alert officials of any athletes trying to manipulate their urine sample with specific, commonly available chemicals tested in this research project.

Dr Fu said, "If we can build a database with all these listed chemicals and their unique markers then this can be incorporated into the current routine drug testing process and potentially revolutionise anti-doping procedures, making drug testing more direct, easy and cost effective."

The ultimate goal of this continued research is to develop and identify the unique markers to monitor chemical manipulation of urine specimens practised by cheating athletes without incurring additional costs to testing laboratories.

Currently authorities can test for masking chemicals, however they cannot test every sample. Some athletes who use masking agents to conceal drug abuse can still slip through the cracks. In addition to this, tests are only run when there is an unusual sample or when a sample is suspected to have been tampered with and testing every chemical can be expensive.

"We are still in the early stages of this project but we hope to present our results and engage with anti-doping agencies in the future, working with them to apply our findings to their drug testing and analysis procedures," said Dr Fu.

Provided by University of Technology, Sydney

Citation: Using science to catch a cheat (2012, August 22) retrieved 5 May 2024 from <u>https://medicalxpress.com/news/2012-08-science.html</u>

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