

## **“Influence of renal flow rate on urinary concentration of compounds of interest to anti-doping agencies”**

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### **Project overview**

Changes in the rate of urine formation will affect the concentration of doping agents in the urine, but may not do so in a uniform manner. This raises the possibility that athletes may manipulate urine flow rates to evade detection of prohibited substances. It also offers a potential basis for appeal by an athlete who has failed a test. A tested athlete may be acutely dehydrated after training or competition, resulting in an extremely high total solute concentration in the urine sample obtained. If athletes are unable to produce a sample, and are allowed water or other drinks to stimulate urine flow the solute concentration of the urine sample obtained may then be extremely low due to an acute increase in urine flow rate. This is likely to be followed by a refractory period during which lipid-soluble metabolites will be excreted in lower than normal amounts as these compounds will be released from lipid depots at a relatively constant rate. Any sudden change in urine flow rate is likely to disturb this equilibrium and result in a temporary mis-match between concentrations in the tissues and the urine. It is therefore important to quantify the effects of changes in urine flow rate on the excretion patterns of prohibited substances so that allowance may be made for these effects. Urine composition may be affected by acute changes in the rate of urine formation, due to differences in the size, polarity, lipid solubility and other physio-chemical properties of components excreted. Changes in the measured concentration and/or time-course of excretion of diagnostic markers for prohibited substances will be of interest to anti-doping. A fundamental understanding of the effect of acute changes in hydration status will be particularly important in establishing acceptable parameters for metabolite excretion profiles with the application of the athlete passport.

### **Results and Conclusions**

This project examined changes in the time-course of excretion of diagnostic markers for prohibited substances in response to acute fluid loads and dehydrating exercise. Fundamentally this work aimed to answer the following questions; could an athlete cheat a doping test by drinking large volume of water or inadvertently test positive when dehydrated and is the current urine specific gravity correction fit for purpose? The present data demonstrate that ingestion of a large bolus of fluid not only results in the dilution of all steroids present in the urine, but also alters the excretion profile of these compounds to varying degrees; as evidenced by varying changes in T:E and the other ratios. While these effects display somewhat high

inter-individual variability, the overall responses are consistent across both studies described in this report and highlight a need to further consider hydration status when interpreting steroid profile data collected as part of the Steroid Module of the Athlete Biological Passport. To limit opportunities for athletes to manipulate the outcome of the test, firm guidelines should be established to limit drinking to a fixed volume known to simulate sufficient diuresis in the vast majority of cases.

*Conference presentations*

Phillip Watson, Samuel Tam, David Cowan and Ronald J. Maughan. (2013) The influence of increased renal flow rate on urinary concentration ratio of testosterone to epitestosterone. 60th Annual Meeting, American College of Sports Medicine. Indianapolis, Indiana.