"Insulins and doping: how long can we detect them in blood and urine?"

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Insulins are therapeutically used for the treatment of diabetes mellitus. There are rumors that insulins are used by athletes for anabolic properties. Consequently, their use is prohibited by WADA. To control their abuse several sensitive methods for the detection of insulins in blood and urine have been described for doping control purposes. Generally, the applicability of these methods is illustrated with blood and urine samples from diabetic patients. Indeed, blood and urine samples can be easily collected from diabetic patients without major ethical concern. Unfortunately, it cannot be excluded that these samples are not representative for a healthy athlete population because of the diabetic status of the patients. Additionally, these spot-samples don't give information on detection times. In general, no administration studies, from which the results are readily applicable to doping-control, have been performed. Therefore, the aim of this project is to administer a single dose of insulins to healthy volunteers and to investigate detection times in blood and urine.

Because administration of a high dose of insulins can result in a life-threatening situation only a low dose will be administered (0.05IU/kg). Three short acting insulins Lispro, Aspart and Glulisine will be investigated. Blood and urine samples will be collected from 1 week before administration, until 3 days after administration. The result of this project will be useful for doping organizations to set testing windows and for doping laboratories to evaluate their detection methods.

Results and Conclusion:

A simplified immunoaffinity purification LC-HRMS method was presented for the identification of the synthetic insulin analogue Lispro, Aspart and Glulisine in serum and urine samples. LODs obtained in serum for all 3 compounds was 500 pg/ml. In post administration serum samples, the insulins were detectable for several hours.

More importantly, urinary detection resulted in much better results in terms of method development, validation (LODs 5 pg/ml, LOIs 10 pg/ml) and detection windows of these three rapid-acting insulins. Following the single injection (0.05 IU/kg), the administered analogues could be detected longer than in blood and identified according to the TDICR2015 document using the presented analytical strategy.

Publications/Presentations

- Judak P, Coppieters G, Deventer K, van Eenoo P, Urinary detection of insulin analogues: Improvements in the Ghent laboratory, Manfred Donike Workshop, 38th Cologne Workshop on Dope Analysis, 09.02.2020 - 14.02.2020

- Péter Judák, Gilles Coppieters, Bruno Lapauw, Peter Van Eenoo, Koen Deventer, Urinary detection of rapid-acting insulin analogues in healthy humans, Drug Testing and analysis, accepted. http://dx.doi.org/10.1002/dta.2817