

Project Review

“Detection of steroids by fast gas chromatography triple quadrupole tandem mass spectrometry (GC-QqQ)”

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Gas chromatography mass spectrometry (GC-MS) is a technique routinely used for screening of doping control samples on the misuse of anabolic steroids. The current project would use a novel type of instrument, namely a triple quadrupole tandem mass spectrometer (GCQqQ-MSn) to develop a method which is faster and is capable of detecting lower concentrations of prohibited anabolic steroids. This would allow for longer detection times of steroid misuse and higher sample throughput (i.e. faster reporting times).

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Results and Conclusions

The use of performance enhancing drugs in sports is prohibited. For the detection of misuse of such substances gas chromatography or liquid chromatography coupled to mass spectrometry are the most frequently used detection techniques. In this work the development and validation of a fast gas chromatography tandem mass spectrometric method for the detection of a wide range of doping agents was developed and validated.

The method is capable to detect quantitatively 13 endogenous steroids (the steroid profile), 19-norandrosterone, salbutamol and 11-nor- Δ^9 -tetrahydrocannabinol-9-carboxylic acid in the applicable ranges and to detect qualitatively over 140 substances in accordance with the minimum required performance levels of the World Anti-Doping Agency in 1 ml of urine. The classes of substances included in the method are anabolic steroids, β_2 -agonists, stimulants, narcotics, hormone antagonists and modulators and beta-blockers. At these levels the identification according to WADA's criteria for identification using chromatography and mass spectrometry was achieved.

Moreover, by using a short capillary column and hydrogen as a carrier gas the run time of the method is less than 8 min. This means the method is –in general- three times faster than most methods used routinely for the analysis of doping control samples. Hence, the method allows for a high throughput allowing faster reporting times and reduced instrument costs.

Hence, this method is capable of detecting and confirming a wide range of doping substances at very low concentration in a short time. Such improvements increase the efficiency in anti-doping laboratories and allow for faster reporting. Additionally, the use of multiple internal standards allows for the evaluation of the quality of every single step in the analytical methodology.

Publications:

A fast, comprehensive screening method for doping agents in urine by gas chromatography–triple quadrupole mass spectrometry. Van Eenoo P, Van Gansbeke W, De Brabanter N, Deventer K, Delbeke FT. *J. Chromatogr. A* 1218 (2011) 3306-3316.

Presentations:

1. Van Eenoo, P, Van Gansbeke, W, Delbeke FT: A fast GC-MS method for screening anabolic steroids Manfred Donike Workshop, 28th Cologne Workshop on Dope Analysis, 7.-12.3.2010
2. Van Eenoo, P, Van Gansbeke, W, De Brabanter, N, Delbeke FT: A fast GC-MS triple quadrupole method for screening of a wide range of doping Agents Manfred Donike Workshop, 28th Cologne Workshop on Dope Analysis, 7.-12.3.2010
3. Van Eenoo P, Van Gansbeke W, De Brabanter N, Deventer K, Delbeke FT. A fast comprehensive screening method for doping agents in urine by GC-QQQ-MSn. 34th International Symposium on capillary Chromatography, Riva del Garda (Italy), 30/5-4/6/2010
4. Van Eenoo P, The use of modern chromatography and mass-spectrometry in a doping lab, RIC seminar 2010, 2/12/2010, 14/12/2010 and 17/12/2010