Project Review

"Carbon Isotope Ratio Determination and Investigation of Possible Presence of Manipulating Substances in Seized Testosterone"

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Determining the origin of testosterone and other steroids in human urine is a major issue in doping control. Looking at the latest published laboratory statistics of 2007 from the World-Anti-Doping Agency (WADA), testosterone was by far the most frequent reported adverse analytical finding among the anabolic steroids. Since it is well known that natural outliers of a normal steroid profile exist, a further investigation is recommended after a finding of an elevated testosterone/epitestosterone ratio or high testosterone levels. Commonly, an isotope ratio mass spectrometric (IRMS) analysis is conducted. Of the samples submitted to IRMS analysis, however, surprisingly few are reported as positive findings.

In the proposed project confiscated testosterone preparations will be investigated. Through a close collaboration with the Special Task Force "Doping" of the Austrian Ministry of Internal Affairs, the Doping Control Laboratory in Seibersdorf is in the unique position to have access to a significant amount of seized testosterone and other anabolic preparations.

The aim is to determine whether these products have been manipulated, with respect to carbone isotope ratios, in order to prevent a positive IRMS finding. Additionally, it will be investigated to what extent the preparations contain the masking agent epitestosterone. Epitstosterone may be used as a measure to manipulate a doping control result, by lowering the testosterone/epitestosterone ratio in urine steroid profiles. Thereby, a further investigation of the sample may not come into consideration.

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Results and Conclusions

In the present study, the content of a number of black marked testosterone products collected in Austria has been analyzed. Additionally, $\delta\ ^{13}C$ ‰ values were measured for testosterone in the products after cleavage of the testosterone ester. The aim was to determine whether these products had been manipulated, with respect to carbon isotope ratios, in order to prevent a positive isotopic ratio mass spectrometric (IRMS) finding in doping control. Moreover, it was investigated to what extent the preparations were containing the masking agent epitestosterone, in order to lower the testosterone/epitestosterone ratio in urine steroid profiles. Out of 30 analyzed products, the declared ingredients differed from the actual content in 10 cases. Epitestosterone, however, could not be found in any of the products. The products displayed $\delta\ ^{13}C$ ‰ values between –23.6 and —29.4. For more than half of these products, the $\delta\ ^{13}C$ ‰ values were above – 26 and within a range reported for endogenous urinary steroids. Hence, the the current study clearly shows the extent of availability of testosterone products with endogenous-like carbon isotope profiles on the black market. Consequently, the applicability of the IRMS – technique to detect the use of these products is currently reduced. It is therefore considered important to continue monitoring this development and intensify research on alternatives for the detection of testosterone misuse.

Publications and Presentation

Carbon Isotope Ratio Determination and Investigation of Possible Presence of Manipulating Substances in Seized Testosterone Preparations in Austria. G. Forsdahl, C. Östreicher, M. Koller, G. Gmeiner. Cologne Workshop, 2010.

Carbon Isotope Ratio Determination and Investigation of Possible Presence of Manipulating Substances in Seized Testosterone Preparations in Austria. Manuscript in preparation