

PROJECT REVIEW

“Study on the detection of dope testosterone manipulated with ¹³C labelled standards”

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Testosterone, an endogenous steroid banned by the World Anti-Doping Agency, is still one of the most widely used performance-enhancing drugs in the athletic community. Isotope ratio mass spectrometry (IRMS) is a commendatory technology used to detect urinary endogenous steroids by determination of the carbon isotope ratio (¹³C value). Recent investigation revealed that ¹³C labeled testosterone standard could be used to regulate the ¹³C value of testosterone products and lead to the false negative results in doping test. With increasing availability of the manipulated testosterone, significant efforts are needed by anti-doping authorities to develop methods to detect its abuse.

The aim of this study is to establish method for the detection of testosterone manipulated with ¹³C labeled standards. The key difference in structure between manipulated testosterone and non-manipulated testosterone is that certain amount of C-3 or/and C-4 are labeled by ¹³C in manipulated product which makes significant positive contribution to ¹³C value. In this study, chemical reactions will be explored to remove C-3 or C-4. For the manipulated testosterone, the ¹³C value of resultant of the reaction would be more negative than that of the reactant. By comparing the ¹³C values of reactant and resultant, the manipulated T could be detected.

"Study on the detection of dope testosterone manipulated with ^{13}C labelled standards"

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Results and Conclusions

^{13}C labeled standards can be used to control the $\delta^{13}\text{C}$ value and produce manipulated testosterone (T) which cannot be detected by the current isotope ratio mass spectrometry (IRMS) method. The aim of this study is to establish a method for the detection of T manipulated with ^{13}C labeled standards. A method was explored to remove the ^{13}C labeled atom at C-3 in androsterone (Andro), the metabolite of T in urine, to produce the resultant (A-nor-5 α -androstane-2,17-dione, ANAD). The difference in $\delta^{13}\text{C}$ values between Andro and ANAD ($\Delta\delta^{13}\text{C}_{\text{Andro-ANAD}}$, ‰) would change significantly in case manipulated T is abused. After administration of T manipulated with ^{13}C labeled standards, urine samples were collected from volunteers and analyzed with the established method. Based on the population reference, the cut-off value of $\Delta\delta^{13}\text{C}_{\text{Andro-ANAD}}$ for positive result was assessed. The developed method could be used to detect T manipulated with 3- ^{13}C labeled standards. The study results have been published in *Analytica Chimica Acta* (DOI: 10.1016/j.aca.2014.09.007).