

## PROJECT REVIEW

### ***“Influences of Traditional Chinese Medicines Containing Endogenous Steroids on Doping Test”***

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Traditional Chinese Medicine (TCM) has been used in China for thousands of years. Some drugs of TCM contain endogenous steroids such as musk, penis and testes of ox, and oviductus ranae, which make it possible to abuse TCM as doping. In the 2011 FIFA Women's World Cup, adverse analytical findings about the exogenous source of etiocholanolone and other steroids were reported, and musk was regarded as the source of the steroidal preparation. Isotope ratio mass spectrum is applied in doping test to confirm the endogenous steroids abuse by determining the isotopic ratio of  $^{13}\text{C}/^{12}\text{C}$ , whereas the carbon isotope ratios of steroids in animal materials used in TCM were seldom reported in literature. In view of the fact that TCM materials would be abused as doping, their influences on doping test should be further studied.

In this project, musk, penis and testes of ox, and oviductus ranae will be collected for the detection of concentrations and carbon isotope ratios of endogenous steroids by GC-MSD and GC/C/IRMS. Excretion study will also be executed to demonstrate the influences of musk intake on the doping test.

Based on those studies, the possibility of those TCMs abuse as doping will be estimated.

### **Results and conclusions:**

Traditional Chinese Medicine (TCM) has been used for a long time. Some TCMs contain prohibited steroids, which make it possible to abuse TCMs as doping. In this study, steroid contents and  $\delta^{13}\text{C}$ -values were analyzed in musk, penis-testes of ox, and forest frog's oviduct. Excretion study was executed to demonstrate the influences of musk ingestion on doping control.

The analysis on 20 batches of musk illustrated that the contents of androgen were greater than that of estrogen and progestin in musk. Etio,  $5\alpha$ - $3\beta$ - $17\alpha$ -diol,  $5\beta$ -diol, and An were main androgen in musk. IRMS analysis demonstrated that the androgen in wild deer musk possessed  $\delta^{13}\text{C}$ -values in the range of exogenous steroid values, while the steroid  $\delta^{13}\text{C}$ -values in domestic deer musk samples were within the normal range of human body.

In penis-testes of ox, An, Etio, DHEA, DHT, 4-AD, T, EpiA, and Preg were detected; Chol had average  $\delta^{13}\text{C}$ -value of -22.6 ‰. In forest frog's oviduct,

Preg and 5 $\beta$ -diol could be identified; Chol bore the average  $\delta^{13}\text{C}$ -value of -27.8 ‰.

In musk excretion study, 200 and 100 mg of wild and domestic deer musk samples were administrated by 29 subjects. The urinary profile showed changes, but the changes were inconsistent among subjects. The fluctuations might be proportional to the musk quality. In the IRMS test, the  $\delta^{13}\text{C}$ -values of Etio and 5 $\beta$ -diol were more sensitive than other markers, and AAFs were obtained. It is the first report about the AAFs in the musk administration study.