PROJECT REVIEW

"Statistical significance of hair analysis of clenbuterol to discriminate therapeutic use from contamination"

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Hair samples are approved as alternative biological matrices in doping control and provide potential access to retrospective long-term information on substance abuse. Nevertheless its application in doping control is restricted to few applications, mainly due to considerably (esp. compared to urine) low target concentrations of xenobiotics. Basic lipophilic compounds are generally preferentially integrated into hair and clenbuterol in particular represents an outstanding candidate for hair incorporation due to its intense melanin-binding. In spite of its low therapeutic dosages, single or occasional therapeutic administrations resulted in positive identification of clenbuterol in hairs. As a consequence of a recent accumulation of low-level findings of clenbuterol in doping controls, hair analyses were suggested to narrow down potential origins. This is apparently a reasonable approach because of the excellent incorporation rate and detection limit. However, the quantitative interpretation of hair analyses is mainly emerged from the field of drugs of abuse and focused on high dosages and long term abuse.

There is little information on quantitative evaluations of single and/or sub-therapeutic levels. It's therefore the aim of this project to collect data on the occurrence of clenbuterol in hair and its statistical significance after low-level incorporation of clenbuterol. From a practical point of view, it is intended to propose threshold values for the quantitative differentiation of therapeutic or abusive applications of clenbuterol and evaluate influencing parameters (hair pigmentation).

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Results and Conclusion

Clenbuterol is a well-known β2-agonist, which is banned for use in sports and strictly regulated for the use in livestock industry. Parallel to improvements of clenbuterol detection limits, an increasing number of positive results were found in doping control samples and in samples from residents or travelers from high-risk countries and were often suspected to be caused by the illegal use of clenbuterol, e.g. for cattle fattening.

In this project asensitive LC-MS/MS method was developed to detect low clenbuterol residues in hair with adetection limit of 0.02 pg/mg. The present study consists of two parts: first, a sub-therapeutic application study and second, a study with volunteers, who were subject of a high contamination risk.

In both parts hair and urine samples were analyzed. In case of the application study serum was additionally analyzed. For the first part, a total dosage of 30 µg clenbuterol was applied to 20 healthy volunteers on five subsequent days. One month post administration clenbuterol was detected in the proximal hair segment (0-1 cm) in concentrations between 0.43 and 4.76 pg/mg. No statistical differences were detected between gender or hair pigmentation (brown vs. dark brown color). Serum and urine samples were taken 90 min after each applicationand a correlation between dosage, measured clenbuterol concentration and their inter-individualvariance was observed. For the second part, samples of 66 Mexican soccer players were analyzed. In 89 percent of these volunteers, clenbuterol was detectable in their hair at concentrations between 0.02 and 1.90 pg/mg. A comparison of both parts showed no statistical difference between sub-therapeutic application and contamination. In contrast, discrimination from typical abuse of clenbuterol is apparently possible.