

PROJECT REVIEW

“Influence for Changes in Diet on the Dynamics of $^{13}\text{C}/^{12}\text{C}$ in Selected Urinary Steroids”

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The $^{13}\text{C}/^{12}\text{C}$ -ratio of urinary steroids is an accepted parameter to detect abuse of androgenic anabolic steroids. Significant differences in $^{13}\text{C}/^{12}\text{C}$ between selected reference and target steroids are regarded as an unequivocal evidence for presence of synthetic material. However theoretically this procedure might result in false positive cases: Significant differences in isotope ratios might result when isotopic composition of diet changes within a short period of time and when physiological carbon fluxes to reference and target compounds are of different order of magnitude.

Isotopic composition of diet necessarily changes after transcontinental travelling due to different contributions of isotopically distinct carbon sources of diet. On the other hand, few is known concerning the exchange rates of carbon during steroid biosynthesis.

The aim of the study is to elucidate the dynamics of carbon exchange in steroid metabolism. This will help to obtain significantly more insight into the quality of information given by isotope ratio analysis of urinary steroids.

The study requires systematic variation of isotopic composition of diet in a longitudinal study with few selected subjects. When possible, we intend to develop explicit models for the carbon fluxes in steroid metabolic pathways.

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Results and Conclusions

- The exchange rates of the carbon pools for the biosynthesis of steroid hormones may be different for different compounds.
- As a consequence, the differences in isotopic composition between endogenous urinary steroids ($\Delta^{13}\text{C}$ -values) temporarily may increase during switch to a diet with a largely different isotope signature.
- Theoretical considerations suggest that in some individuals the increase of the elevated $\Delta^{13}\text{C}$ -values may remain for comparably long periods (weeks to months).
- There is a large biological variance concerning these phenomena. Whereas in some individuals the exchange rates are virtually identical, other individuals may exhibit significant differences.
- The exchange rates vary significantly between individuals in absolute terms. Body mass and physical activity are likely to play a pivotal role.
- The contribution of cholesterol to the biosynthesis of steroids varies between different individuals.
- The most robust comparison appears to be A vs. OHA. These two steroids exhibit comparable exchange rates in most of the subjects. However, this is not necessarily the case (see subject 8, 3.2.8).
- If possible, evaluation of two reference compounds should be considered.

Publications

- Influence of changes in diet on the dynamics of $^{13}\text{C}/^{12}\text{C}$ -ratio in selected urinary steroids. Part I: Study design, $^{13}\text{C}/^{12}\text{C}$ -ratio of applied foodstuffs and effect on anthropometrical data. U. Flenker, C. von Kuk, U. Güntner, F. Hülsemann, V. Gougoulidis, W. Schänzer. Manfred Donike Workshop 2005
- Influence of changes in diet on the dynamics of $^{13}\text{C}/^{12}\text{C}$ in selected urinary steroids: diet free from cholesterol. U. Flenker, C. von Kuk, U. Güntner, F. Hülsemann, V. Gougoulidis, W. Schänzer