

Highlights of Analytical Sciences in Switzerland

Division of Analytical Sciences

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Occurrence of Natural Hepatotoxins in Herbal Teas

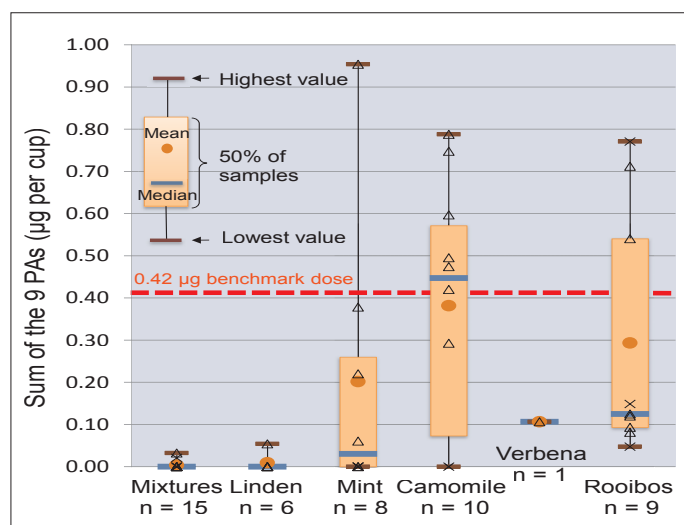
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Keywords: Food safety · Herbal teas · HPLC-MS/MS · Pyrrolizidine alkaloids

Pyrrolizidine alkaloids (PAs) are a large class of secondary metabolites naturally occurring in many botanicals worldwide. PAs that contain a 1,2-unsaturated necine base and are esterified on the hydroxymethyl group at C(1) and/or C(7) cause hepatotoxicity. Thus, consumption of PA-contaminated food or beverages may lead to acute or chronic hepatic veno-occlusive disease. Herbal-derived food products are probably the major source of exposure but data are still very scarce. Following several cases of intoxications and toxicological studies, risk assessment agencies have proposed various limits for maximal daily PA intake. Up to now, legal limits for PAs in food exist neither within the EU nor in Switzerland. The generally accepted benchmark dose for an adult corresponds to about 0.42 μg of unsaturated PAs per day. In our study dealing with 70 teas and herbal teas, 24 beverages were found to contain PAs >LOQ: 0.02 $\mu\text{g}/\text{cup}$ (200 mL). The identity of the natural toxins was confirmed by high-resolution MS. Quantification of the nine 1,2-unsaturated PAs varied from 0.02 to up to 0.95 μg . Analysis were conducted with a validated UHPLC-MS/MS method implementing sub 2- μm core-shell particles. Results indicated that the sum of screened PAs was higher than the recommended maximum dose in 10 samples. All rooibos samples were positive suggesting that small amounts of PAs are occurring naturally. In the other contaminated samples, the presence of PAs is possibly due to cross-contamination with PAs-containing botanicals during harvesting, storage and/or transport.



Box plot of PA amounts measured in one cup of tea or herbal tea preparation.

Results of this survey show that the long-term consumption of highly contaminated herbal tea exposes consumers, and particularly pregnant women and infants, above the reference level of possible health impairment. Consequently, the herbal infusion industry is urged to monitor contamination levels and to find solutions to secure an acceptable margin of exposure.

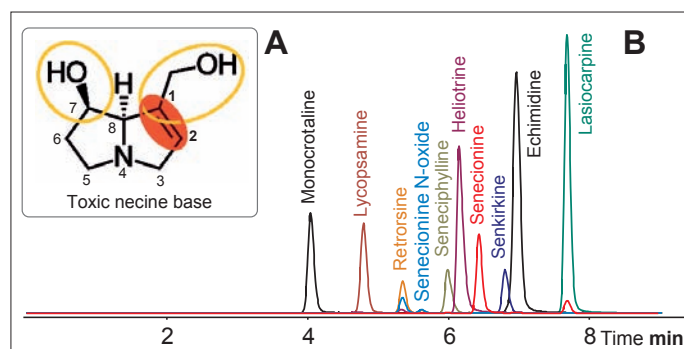
Received: February 18, 2015

Reference

C. Mathon, P. Edder, S. Bieri, P. Christen, *Anal. Bioanal. Chem.* **2014**, *406*, 7345.



Samples of selected teas and herbal teas from the Swiss market.



A, Structure of the hepatotoxic moiety of PAs; B, UHPLC-MS/MS chromatogram of a standard mixture at 50 $\mu\text{g}/\text{L}$.

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