Koehler K[1], Geyer H[2], Guddat S[2], Orlovius A[2], Parr MK[2], Thevis M[2], Mester J[1], Schänzer W[2]

Sibutramine Found in Chinese Herbal Slimming Tea and Capsules

[1]German Research Centre of Elite Sports, German Sport University, Cologne, Germany
[2]Centre for Preventive Doping Reserach, German Sport University, Cologne, Germany

Introduction

Until recently, the history of faked or contaminated nutritional supplements mainly concerned anabolic androgenic steroids (Geyer et al. 2004, Parr et al. 2007), whereas banned stimulants (such as ephedrine and caffeine) found in supplements were mostly linked to their natural occurrence in certain plants (Parr et al. 2003). Yet, within the last years, several cases of Chinese herbal products containing N-nitroso-fenfluramine have been reported (Adachi et al. 2003, Kawata et al. 2003).

Recently, Jung et al. (2006) reported the finding of the anorectic drug sibutramine in Chinese slimming capsules. As a consequence, German custom authorities confiscated large amounts of two similar products (Lida Meizitang, Lida DaiDaihua; supplier: Kunming Dali Industry & Trade Co., Ltd., China) and an official consumer warning concerning these products was published (Zollfahndungsamt Frankfurt am Main 2006).

The present report describes the finding of sibutramine in a “pure herbal” slimming tea and confirms that slimming capsules from the same supplier contain high amounts of sibutramine.

Materials and Methods

Two users of Chinese slimming products reported to the laboratory after experiencing increased arousal and appetite suppression following the use of the products LiDa Nice Figure Slimming Tea and LiDa Dai Dai Hua Jiao Nang Slimming Capsules. In both cases, urine samples were collected for at least 2 days. Each user plausibly stated to have consumed the products as recommended and not to have used the product within the preceding week.

The tea, which was labelled to contain “Wild tea, seed of sickle and Tuckahoe”, was analyzed for sibutramine. As recommended, one tea bag was extracted with 200 mL of boiling H_2O for

5 minutes and an aliquot was diluted with aqueous hydrochloric acid (HCl, 0.06 M) for liquid chromatography-tandem mass spectrometry (LC-MS/MS) measurement.
Secondly, an aliquot of the homogenized content of 10 capsules was supersonicated with HCl (0.06 M) and the solution was further diluted before measurement.
For an estimation of the sibutramine concentration in the measurement solutions, a linear regression model was established with eight calibrators (concentration range: 0.5-22 $\mu g \cdot mL^{-1}$; $R^2 = 0.993$). Before injection, d_5-isoxuprine was added to the solutions as internal standard at a concentration of 2.5 $\mu g \cdot mL^{-1}$.
All urine samples provided by the two users were analyzed for sibutramine metabolites according to a method recently described by Thevis et al. (2006). The urinary concentrations of the two major metabolites, desmethyl sibutramine (M1) and bisdesmethyl sibutramine (M2) were estimated with the use of two calibrators (concentrations: 50 $ng \cdot mL^{-1}$ and 200 $ng \cdot mL^{-1}$) and a blank urine sample.

Results and Discussion

The presence of sibutramine in the tea was confirmed by comparing the relative abundances of three ion transitions (m/z = 280/125, 180/139, 280/103) and the retention time (6.49 min) with data from an external standard. The concentration was determined to be 1.8 mg sibutramine per tea serving. On account of the advertised effects of the tea, it can be clearly concluded that this case presents product adulteration.
In the capsules, the presence of sibutramine was also confirmed at a concentration of 34 mg per capsule, which is in good agreement with the prior analysis result by Jung et al. (2006). The concentration exceeds the dose most commonly used in clinical trials (10 – 20 mg; Nisoli & Carruba 2003).

The urinary excretion of the two major metabolites after consumption of the tea preparation is shown in Figure 1 (left). As illustrated by the chromatograms of an urine sample collected five hours after consumption of the tea (Figure 2), both M1 and M2 were clearly detectable. In all urine samples collected, almost no intact sibutramine was detectable (RT = 6.60). The urinary concentration of the more abundant M2 peaks reached a peak concentration of approximately 55 $ng \cdot mL^{-1}$after 5 hours. M2 was still detectable until the cessation of urine collection after 53 hours.
With respect to the higher sibutramine content in the slimming capsules, urinary concentrations of both metabolites were much higher (Figure 1 right).

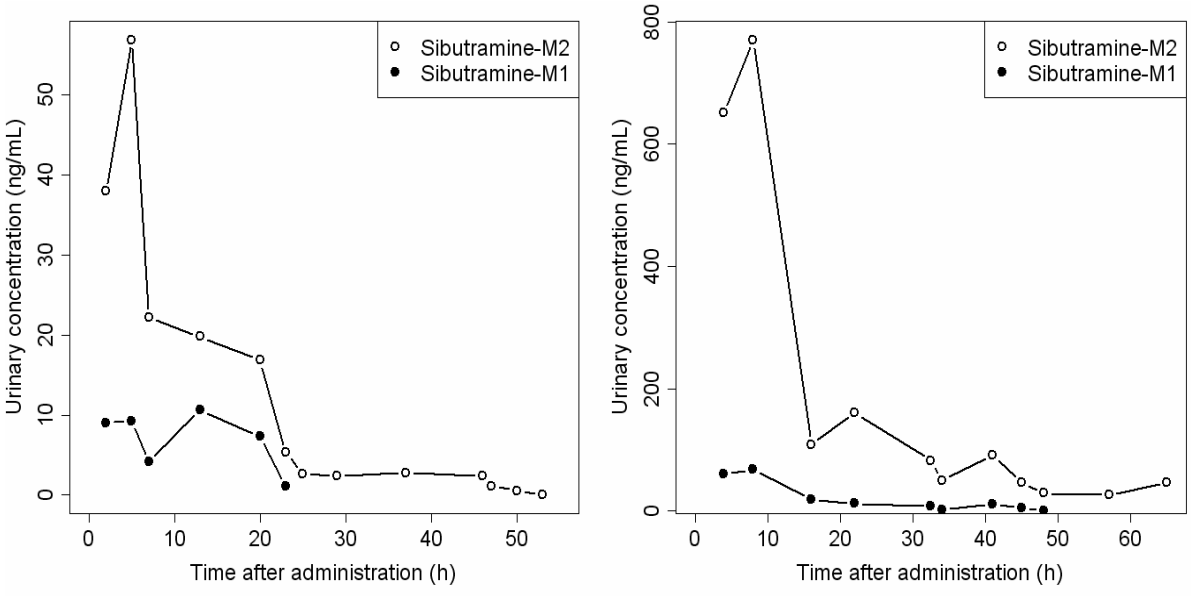

Figure 1: Urinary excretion of bisdesmethyl sibutramine (M2) and desmethyl sibutramine (M1) after consumption of LiDa slimming tea (left) and LiDa slimming capsule

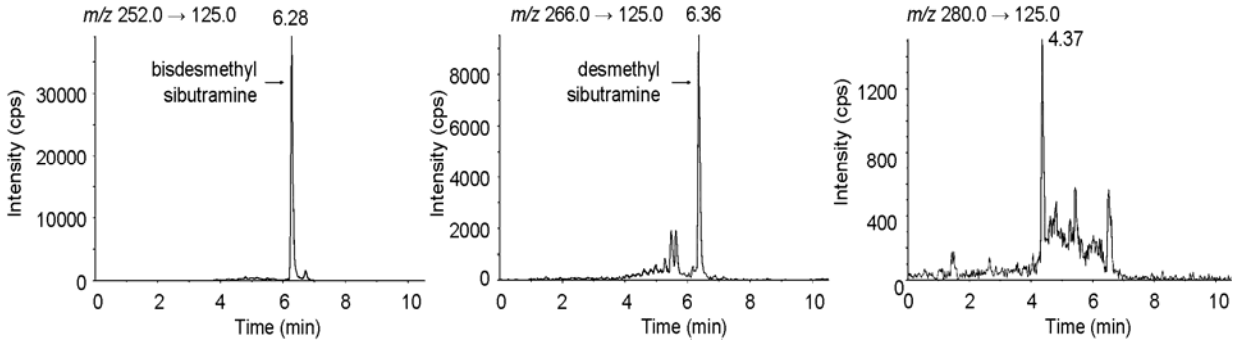

Figure 2: Chromatograms of the most abundant ion transitions of sibutramine and its major metabolites in the urine provided 5 h after consumption of the LiDa slimming tea

Sibutramine is a serotonine-norepinephrine uptake inhibitor. It effectively causes appetite suppression and is therefore used in the treatment of obesity. Side effects such as increased blood pressure and heart rate have been described after the use of sibutramine and require regular monitoring (Nisoli & Carruba 2003).

Besides the apparent health risks to the general public, the presence of sibutramine in two "pure herbal" products could have negative consequences for athletes participating in a doping control system as sibutramine is listed as stimulant by the World Anti-Doping Agency (2007). In the reported cases, the use of the slimming products would have caused a positive doping result for sibutramine. Due to the fact that there was no indication of the sibutramine content, this poses a great doping trap especially to weight-conscious athletes.

Therefore, it is necessary to further raise public awareness and improve regulation of the Internet market in order to protect consumers and athletes from negative effects related to product adulterations.

References

Adachi, M., Saito, H., Kobayashi, H., Horie, Y., Kato, S., Yoshioka, M., Ishii, H. (2003) Hepatic injury in 12 patients taking the herbal weight loss AIDS Chaso or Onshido. *Annals of Internal Medicine* **16**, 488-492.

Geyer, H., Parr, M.K., Mareck, U., Reinhart, U., Schrader, Y., Schänzer, W. (2004) Analysis of non-hormonal nutritional supplements for anabolic-androgenic steroids - results of an international study. *International Journal of Sports Medicine* **25,** 124-129.

Jung, J., Hermanns-Clausen, M., Weinmann, W. (2006) Anorectic sibutramine detected in a Chinese herbal drug for weight loss. *Forensic Science International* **161**, 221-222.

Kawata, K., Takehira, Y., Kobayashi, Y., Kitagawa, M., Yamada, M., Hanajima, K., Murohisa, G., Kawamura, M., Iwaoka, Y., Wada, T., Morita, S., Iwaizumi, M., Makino, S. (2003) Three cases of liver injury caused by Sennomotokounou, a Chinese dietary supplement for weight loss. *Internal Medicine* **42**, 1188-1192.

Nisoli, E., Carruba, M.O. (2003) A benefit-risk assessment of sibutramine in the management of obesity. *Drug Safety* **26**, 1027-1048.

Parr, M.K., Geyer, H., Sigmund, G. Koehler, K., Schänzer, W. (2003) Screening of Nutritional Supplements for Stimulants and other Drugs. In: Schänzer, W., Geyer, H., Gotzmann, A., Mareck, U. (eds.) *Recent Advances in Doping (11*), Köln. pp 67-75.

Parr, M.K., Geyer, H., Hoffmann, B., Köhler, K., Mareck, U., Schänzer, W. (2007) High amounts of 17-methylated anabolic-androgenic steroids in effervescent tablets on the dietary supplement market. *Biomedical Chromatography* **21**, 64-68.

Thevis, M., Sigmund, G., Schiffer, A.K., Schänzer, W. (2006) Determination of N-desmethyl- and N-bisdesmethyl metabolites of Sibutramine in doping control analysis using liquid chromatography-tandem mass spectrometry. *European Journal of Mass Spectrometry* **12**, 129-136.

World Anti-Doping Agency. The 2007 Prohibited List – International Standard, Montreal (2007) http://www.wada-ama.org/rtecontent/document/2007_List_En.pdf. (access date 20.04.2007)

Zollfahndungsamt Frankfurt am Main. Presseinformation, Frankfurt am Main (2006) https://www.zollkriminalamt.de/presse/020606_2.html (access date 02.06.2006)