

Investigation and Risk Assessment of Geranium Products Containing Doping Methylhexylamine

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Abstract

Methylhexaneamine (MHA) was listed as banned stimulant on the 2010 World Anti-Doping Agency (WADA) prohibited list. In addition, the WADA in 2012 special announcement described MHA had other name and derived probably from geranium oil and geranium root extract. Athletes may use accidentally the dietary supplements containing this banned ingredient resulted in loss of game qualification. The purpose of this study was to analyze commercially available geranium oil as aromatherapy in Taiwan. And this information could be useful for athletes. Geranium oil and related products were analyzed by performing liquid chromatography-tandem mass spectrometry (LC-MS/MS). The analytical samples were composed of 10 series of geranium oil, one series of geranium supplement, and one series of geranium tea bag. Amphetamine-d11 was served as internal standard. And a 100 μ L aliquot of oil (or 100 mg of powder) was injected into LC-MS/MS, confirming whether it contained doping MHA substance. Our results showed that the geranium supplement consisted high units of MHA. But neither the geranium oil nor the tea bag had shown detectable MHA concentration. Therefore, we believed that using geranium oil as aromatherapy would not cause doping positive result in urine.

Introduction

Methylhexaneamine (MHA), commonly known as dimethylamylamine or DMAA, is an organic compound and a sympathomimetic drug. In pharmaceutical uses, MHA served as vasoconstriction and nasal decongestant. MHA was classified as a S6 stimulants in the 2010 Prohibited List published by the World Anti-Doping Agency (WADA), which caused it to be prohibited in-competition. In 2011, MHA was reclassified from “non-specified” to “specified” stimulants. WADA notified that MHA has many different variants/names and includes but are not limited to: methylhexanamine, dimethylpentylamine, 2-amino-4-methylhexane, geranamine forthane, geranium root extract or geranium oil. Nutrition supplements consisted of MHA focused on weight control, appetite inhibition, increasing fat burning and sports performance. Numerous cases of doping positive result were caused that athletes intake MHA-containing nutrition supplements. The purpose of this study was to analyze whether geranium oil and related products would cause doping positive results.

Methods

Instruments Agilent Technologies 6410 Triple Quad LC/MS

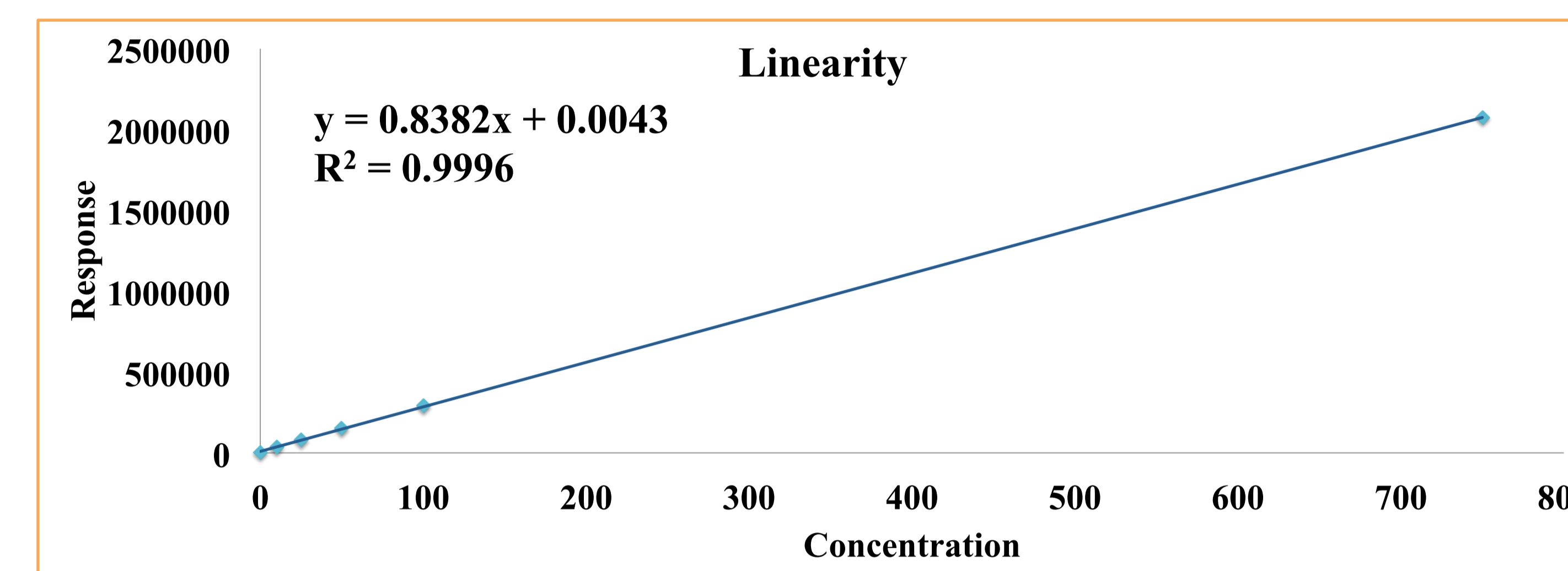
An HP 1200 (Agilent Technologies) liquid chromatograph equipped with a binary pump and a autosampler

Conditions Column:
Supelco Discovery® HS-C18 HPLC column (50 mm \times 2.1 mm),
Supelco Discovery® HS-C18 guard column (2 cm \times 2.1 mm)

Two-solvent linear gradient system:
Solvent A (water and 0.02% formic acid), Solvent B (methanol)

Ionization mode: Electrospray ionization (ESI+)
MRM transitions

Results



Type	Name	Number	Concentration (ng/mL)
Oil	Argital	MHA01	N/D
	Flora Roma	MHA02	N/D
	Sobefyne	MHA03	N/D
	Body Temple	MHA04	N/D
	Quinessence DDO20	MHA05	N/D
	Quinessence DDAO7J	MHA06	N/D
	Norfolk	MHA07	N/D
	aqi	MHA08	N/D
	Latifa's	MHA09	N/D
	Le Jardin	MHA10	N/D
Supplement	GERANIUM20	MHA11	208.61
Tea bag	玫瑰 天竺葵茶	MHA12	N/D

Our results showed that the geranium supplement consisted high units of MHA. But neither the geranium oil nor the tea bag had shown detectable MHA concentration.

Conclusion

It is known geranium-derived products are resources of doping MHA. But our results demonstrated that using geranium oil as aromatherapy would not cause doping positive result. Nonetheless, we still suggested that athletes should be aware when using geranium root extract supplement.

Acknowledgment

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Geranium oil (10 series)

- 100 μ L of oil sample
- Aliquot of 100 μ L + 500 ng Amphetamine-d11 (IS)

Geranium supplement (1 series)

- 100 mg of supplement powder in 10000 mL water
- Aliquot of 50, 500 μ L + 500 ng Amphetamine-d11 (IS)

Geranium tea bag (1 series)

- A tea bag in 15 mL water
- Aliquot of 25, 100, 500 μ L + 500 ng Amphetamine-d11 (IS)