**Supplemental Material A:**

**Details of the qualitative and quantitative analysis of Huperzine A**

*Chemicals:*

Huperzine A was purchased from eNovation Chemicals LLC (Green Brook, NJ 08812 USA). Acetonitrile and formic acid were of HPLC grade purchased from Fisher Scientific (Fair Lawn, NJ, USA). Water was purified using a Milli-Q system (Millipore).

### Preparation of Standard Solution:

Stock solution of huperzine A was prepared at 1.0 mg/mL in methanol. The Liquid Chromatography Mass Spectral (LC-MS) working solutions were serially diluted from stock solution in a range of 10–10000 ng/mL. The calibration curves were prepared at seven different concentration levels.

### Sample Preparation:

Fine powder of testing sample (1 gram) was accurately weighed in a 15 mL centrifuge tube and added 2 mL of 10% hydrochloride solution. After mixing completely, 2.5 mL of methanol added in the sample and mixed again. The sample was extracted with an ultrasonic extractor in water bath for 30 min, followed by centrifugation at 959 × g for 15 min. The supernatant was transferred to a 10 mL volumetric flask. The extraction using 2 mL of methanol was repeated three more times and the respective supernatants were combined. The final volume was adjusted to 10 mL with methanol. Prior to LC analysis, the prepared sample was mixed thoroughly. An adequate volume of extract was passed through a 0.45 µm PTFE filter and collected in a LC sample vial.

## Instrumentation and Analytical methods

Qualitative analysis of dietary supplement products was performed based on the methods reported elsewhere 14 using Agilent Liquid Chromatography-Quadrupole Time of Flight Mass Spectrometry (LC-QToF-MS). In brief, the separation was achieved on C18 column at a flow rate of 0.2 mL/min. The mobile phase consisted of water and acetonitrile, both containing 0.1 % formic acid using a gradient elution. The temperature of the column was maintained at 35 °C. The mass spectrometric analysis was performed with an ESI-QToF-MS/MS and all the operations, acquisition were controlled by Agilent MassHunter Acquisition Software Ver. A.05.00. The data was processed with MassHunter Qualitative Analysis software Ver. B.07.00. Each sample was analyzed in both positive and negative modes in the mass range of *m/z* = 100-1700. The compounds were confirmed by accurate mass spectrum.

Quantitative determination of huperzine A was conducted with a Waters Acquity UPLC HSS T3 column (100 × 2.1 mm i.d., 1.8 um) on a Waters Acquity UPLC system (Waters, Milford, MA) that consists of a binary solvent manager, sample manager, heat controlled column compartment, photodiode array (PDA) detector, and Xevo G2-S QToF mass spectrometer. The instrument was operated by MassLynx NT 4.1. The mobile phases were composed of 0.05 % formic acid of water (A) and acetonitrile containing 0.05 % formic acid (B). Analysis was performed using gradient elution at a flow rate of 0.4 mL/min as follows: 0-10 min, 5 % B to 8 % B; 10-12 min, 8 % to 11 % B; 12-13 min, 11 % B to 100 % B. The analysis was followed by a 3 min washing procedure with 100 % B and re-equilibration period of 3.5 min with initial condition. A strong needle wash solution (90/10; acetonitrile/water, *v*/*v*) and weak needle wash solution (10/90; acetonitrile/water) were used. The column and sample temperature were maintained at 40 °C and 10 °C, respectively. The injection volume was 2 µL.

The MS experiments were carried out on a Xevo G2-S QToF mass spectrometer that was connected to the Ultra High Performance Liquid Chromatography (UHPLC) system via an Electro Spray Ionization interface. The MS parameters was operated in the positive ionization mode as follows: 0.5 kV capillary voltage; 25 V cone voltage; 85 and 450 °C for ion source and desolvation temperature, respectively; 50 and 500 L/h for cone and desolvation gas flows, respectively. Leucine-enkephalin was used for the lock mass at a concentration of 2 ng/mL and flow rate of 5 μL/min. Ions [M + H]+ (*m/z* 556.2771 Da) and a fragment ion (*m/z* 278.1141 Da) of leucine-enkephalin were employed to ensure mass accuracy during the MS analysis. The lock spray interval was set at 30 s, and the data was averaged over three scans. The mass spectrometer was programmed to step between low (15 eV) and elevated (15-35 eV) collision energies on the gas cell, using a scan time of 0.1 s per function over a mass range of *m/z* 100–1200 Da.

The method of quantitative analysis of huperzine A was validated using an authentic plant material *Huperzia serrata* in terms of precision, accuracy, Limit of Detection (LOD), Limit of Quantification (LOQ) and linearity range according to International Counsel for Harmonization guideline. LOD (10 ng/mL) and LOQ (30 ng/mL) were defined as the signal-to-noise ratio equal to 3:1 and 10:1, respectively, and determined by injecting a series of dilute solutions with known concentrations. The accuracy was evaluated for the recovery of huperzine Afrom spiked samples in duplicate. The recovery rate of huperzine A was averaged as 99%. The precision was determined by intra- and inter-day assays on 3 consecutive days with 3 repetitions of each day. The relative standard derivations (RSD) of intra- and inter-day assays were below 9%. The corresponding results were RSD 6.1-8.1% for intra-day and 8.4% for inter-day, respectively. The validated method was suitable for quantitative analysis of huperzine A containing products.

Quantitative determination of huperzine A, a nitrogen containing compound, from dietary supplements was successfully achieved using LC-MS method. In the testing sample, 2 mL of 10% hydrochloride aqueous was used in the extraction solvent to assist huperzine A salts solubility in methanol aqueous solution. For the analysis, mass spectrometry detection with electrospray ionization interface in positive mode produced not only the most sensitive identity of huperzine A from testing samples, but also the better confirmation of huperzine A on the basis of the MS/MS pattern. In the developed LC-MS method, huperzine A formed pronated molecular ions at *m/z* 243.1498 Da ([M+H]+, *calc.* 243.1497) at retention time 10.6 min. The key fragments of huperzine A were *m/z* 226.12 Da ([M+H-NH3]+), 210.09 Da ([226-CH4]+) and 196.07 Da ([226-C2H6]+).

Apart from huperzine A, these supplements were also tested for other non-huperzine ingredients listed on the product labels and considered to be stimulants. Some of these ingredients exhibit pharmacological properties that might potentially cause unpredictable effects on the consumer’s health.