**Additional file 3. Kynurenine level measurement**

Frozen serum samples were thawed at 25°C. Then, 20 µL of the serum sample or calibrator was added to 80 µL protein precipitation solution, which has 1 µL/mL KYN internal standard (KYN-d4). Then, mix the samples using a vortex mixer for 1 min and centrifugation (14,000 rpm, 10 min, 25°C). Further, 10 µL of supernatant was mixed with 90 µL of mobile phase A, and 1 µL of the mixture was injected into the Agilent 1260 Infinity HPLC System (Agilent Technologies Inc.) with a Kinetex pentafluorophenyl propyl column (100 mm×3 mm, 2.6 µm C18 100 Å, Phenomenex, CA, USA). Mobile phase A comprised deionized water containing 0.1% formic acid, and mobile phase B comprised methanol containing 0.1% formic acid. The gradient started with 90% mobile phase A, held 90% mobile phase A for 0.5 min, decreased to 40% mobile phase A within 2.5 min, further decreased to 10% mobile phase A within 1 min, held 10% mobile phase A for 1 min, and finally increased back to 90% mobile phase A in 0.1 min for an equilibration of 1.4 min. The KYN and KYN-d4 were ionized by electrospray ionization in positive ion mode using a QTRAP 5500 (AB SCIEX) and detected by MRM modes m/z 209/94 and m/z 213/122, respectively. As for the repeatability of the assay, the CV was 3.0−4.8% (Additional file 4).