Rapid and Sensitive Analysis of Taurine in Human Serum and Beagle Plasma using Liquid Chromatography-Tandem Mass Spectrometry

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Objective

This work focuses on the development and evaluation of an LC-MS/MS method for the identification of taurine in biological samples such as human serum and beagle plasma.

Introduction

Taurine is a non-essential aminosulfonic acid, often administered externally as a supplement in commercial products such as infant formulas, energy drinks, and contact lens solutions. Typically, chromatographic techniques such as (LC-UV, GC and ion chromatography) and capillary electrophoresis are used for the analysis of taurine. However, the above methods may require extensive sample preparation, and/or lack in sensitivity and specificity required for biological fluids. We report here a sensitive and specific method for the direct determination of taurine in human serum and beagle plasma using liquid chromatography-tandem mass spectrometry (LC-MS/MS). The method was developed and optimized on a Shimadzu LCMS-8050 triple quadrupole mass spectrometer coupled to a Nexera UHPLC liquid chromatograph.

Experimental

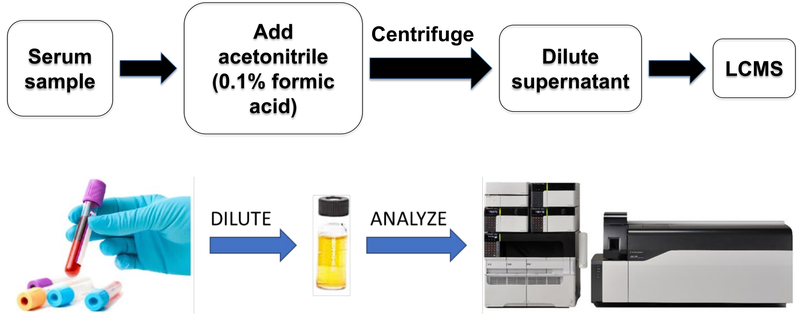

Table 1. Instrument parameters used for the analysis of taurine in serum and beagle plasma.

Nexera UHPLC		LCMS-8050	
Column:	PFPP column (150 × 2.1 mm; 5 µm)	Nebulizing Gas:	2 L/min
Mobile phase:	A: 0.03 % Formic acid in water; B: 0.03 % Formic acid in methanol	Heating Gas:	10 L/min
Flow Rate:	0.3 mL/min	Interface Temp.:	300 °C
Oven Temp.:	25°C	DL Temp.:	250 °C
Injection volume	Method 1: 0.5 µL Method 2: 1.0 µL	Heat Block Temp.:	400 °C
Internal Standard	Method 1: Sulfanilic acid Method 2: Aspartic acid	Drying Gas:	10 L/min

Compounds	Mode	Precursor ion (m/z)	Product ion (m/z)	CE (V)
Taurine	ESI -	124.9	79.9	22
Sulfanilic acid (IS)	ESI -	172.0	79.95	27
Aspartic acid (IS)	ESI -	132.1	88	13

Results and Discussion

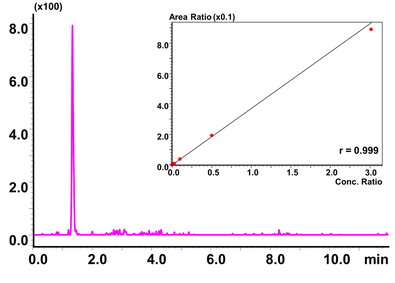

Figure 1. Representative MRM chromatogram for taurine (0.05 µg/mL in serum) using sulfanilic acid as internal standard

- Calibration curve was generated for taurine in serum and beagle plasma.
- Calibrant range in human serum was 0.025-50 µg/mL and 0.5-60 µg/mL in beagle plasma.
- The curves demonstrated excellent linearity (r≥ 0.999).
- No carry over was observed.
- % accuracy of QC injected at low (0.3 µg/mL), medium (1 µg/mL), and high (25 µg/mL) concentration was calculated in serum between 95.2-98.8%.

Table 2. Detection of taurine in unknown beagle plasma samples.

Unknown #	Average (µg/mL)	SD (±)
1	7.4	0.2
2	13.4	0.3
3	15.7	0.8
4	21.1	1.2
5	17.7	0.5
6	36.5	1.2
7	10.2	0.8
8	9.7	0.9
9	12.5	0.1
10	14.8	0.9
11	7..5	0.2
12	16.4	0.0

- The LC-MS/MS method was used for the analysis of taurine in unknown beagle plasma samples.
- The internal standard was modified from sulfanilic acid to aspartic acid to aid counteract matrix effects observed with beagle plasma not previously observed with human serum.
- Percent accuracy of low, mid, and high level QC samples was between 97.6-103.4% with aspartic acid as internal standard.
- Data for 12 unknown beagle plasma samples is shown in table 2. Excellent precision was observed with standard deviation in 0.0-1.2 µg/mL range in beagle plasma.

Conclusions

- A simple, rapid, and sensitive quantitative MRM method was developed for the analysis of taurine in human serum and beagle plasma.
- The method was linear in 0.025-50 µg/mL range with an r value >0.999. The method demonstrated excellent accuracy (95.2-98.8%) with matrix matched QC samples.
- The method was successfully applied for the quantification of taurine in 12 unknown beagle plasma samples with minor modifications.

References

1. Yu et. al. J. Sep. Sci. 2016, 36, 3837-3844.
2. Chitranshi, P. and Gilles, C.T. Analysis of taurine in beagle plasma using LCMS-8050. SSI-LCMS-105 Application News.

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