## Simultaneous Determination of Alternaria Toxins, Ergot Alkaloid Epimers, and Other Major Mycotoxins in Various Food Matrices by LC-MS/MS

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#### Abstract & Introduction

Various food commodities are vulnerable to different types of fungal pathogens and could be contaminated with differential classes of mycotoxins as a result. It is Ideally to implement a generic method for simultaneous determination of multi-mycotoxins in different food matrices or agricultural products. In this study, a simplified sample preparation procedure and a reliable LC-MS/MS analytical method was developed for comprehensive measurement of 38 regulated and emerging mycotoxins including 5 Alternaria toxins, 6 major ergot alkaloids and their corresponding epimers. Four different food matrices (baby wheat cereal, peanut, tomato puree, and blended flour) were chosen for method validation to demonstrate the applicability of this analytical method to a wide range of food types. Sample extraction was performed using a formic acid-acidified 80:20 acetonitrile:water solution followed by extract dry-down and reconstitution in a 50:50 water:methanol solution for injection analysis on a Biphenyl LC column. Chromatographic analysis was performed using LC-MS friendly acidic mobile phases and completed with a short 11-minute cycling time for proper separation of ergot alkaloid epimers. Accurate quantification was achieved using matrix-matched calibration standards at the range of 0.4 to 400 µg/kg. The recoveries of all mycotoxins (except citrinin) in fortified samples were from 70% to 120%, and the relative standard deviation (RSD) was less than 20%. For the vast majority of analytes, the limit of quantification was at 0.4 µg/kg which was satisfactory to meet the regulatory levels.

#### Sample and Matrix-Matched Standards Preparation

Two grams of the sample were weighed into a 50-mL polypropylene centrifuge tube and fortified at 5, 50, and 200 µg/kg with stock standard solution. After sitting at room temperature for 10 minutes, 16 mL of extraction solution containing 0.5% formic acid (no formic acid for tomato puree) were added and the tube was stirred to gain homogenous suspension. The extraction was carried out by shaking horizontally on a digital pulse mixer (Glas-Col LLC, Terre Haute, IN) at 800 rpm for 20 minutes. After centrifuging for 5 minutes at 4000 rpm, 1 mL of extract was evaporated to dryness at 45°C under a gentle stream of nitrogen. The dried extract was reconstituted with 1 mL of 50:50 water:methanol solution and a 0.4 mL aliquot was transferred to and filtered using a Thomson SINGLE StEP filter vial with a 0.2 µm PTFE filter (Restek Cat.# 25874). To prepare matrix-matched calibration standards, the non-fortified matrices were extracted and dried down as described for the sample preparation procedure followed by reconstitution in 50:50 water/methanol solution containing 0.05 – 50 ng/mL of analytes which equals to 0.4 – 400 µg/kg of sample concentration.

#### Results & Discussion

- (1) Chromatographic Performance: A fast chromatographic method using the Raptor Biphenyl column was established (see Table 1) for simultaneous analysis of 38 mycotoxins with a 11-minute total cycling time (Figure 1). Analytes were detected with ESI+ and the MRMs were shown in Table 2. All epimer pairs of ergot alkaloids were chromatographically separated for definitive and accurate quantification. It was noted that whenever a new Biphenyl column was used, it would need to be rinsed and maintained under the mobile phase overnight to gain an acceptable and quantifiable peak shape for tenuazonic acid.
- (2) Linearity: It was shown that a consistent and most suitable linearity of all analytes could be obtained with a quadratic regression (1/x weighted). The lowest concentrated standards were varied due to the differential MS ionization of analytes and specific matrix effect of different food matrices. Nevertheless, most analytes were quantifiable at the full range of  $0.4 - 400 \mu g/kg$  and all compounds showed proper linearity with r<sup>2</sup> > 0.997 and deviations < 30% (Table 3).
- (3) Accuracy & Precision: For each food sample, 3 batches of analyses were performed on different days with a total of 9 repetition of each fortified level. The average recovery and relative standard deviation (RSD) were shown in Table 4. Except citrinin in solid samples, all analytes had the recovery of 72 – 112% of for 3

### Methods

#### Table 1: Analytical Conditions (Waters Xevo TQ-S with Acquity UPLC)

Raptor Biphenyl 2.7µm 100 mm x 2.1 mm (Restek Cat.# 9309A12)									
Raptor Biphenyl EXP Guard Column Cartridge 2.7µm, 5 mm x 2.1 mm (Cat.# 9309A0252)									
0.05% formic acid in water									
0.05% formic acid in methanol									
Time (min)	%B								
0.00	25								
5.00	50								
9.00	100								
9.01	25								
11.00	25								
0.4 mL/min									
5 μL									
60°C									
Scheduled MRM in positiv	ve ESI								
	(Restek Cat.# 9309A12) Raptor Biphenyl EXP Guar 2.7μm, 5 mm x 2.1 mm (C 0.05% formic acid in wate 0.05% formic acid in meth 10.00 5.00 9.00 9.01 11.00 0.4 mL/min 5 μL								

#### Food Products

Baby wheat cereal, raw peanut, tomato puree, and flours were purchased from

fortification levels among 4 different types of food matrices. The satisfactory method precision was demonstrated with the %RSD of within 0.5 – 12%. For solid samples, the use of formic acid-containing extraction solution was necessary to obtain adequate recovery for fumonisin Bs but resulted in low recovery (24 – 36%) of citrinin. For food with high water content such as tomato puree, acceptable recovery of both fumonisin Bs (90 – 94%) and citrinin (72 – 77%) were achievable without the addition of formic acid. Due to specific matrix interference, nivalenol could not be measured in baby wheat cereal. The negative impact of matrix interference could also be observed for deoxynivalenol, fusarenon X, and patulin for tomato puree analysis in which the 5 µg/kg fortification sample was not quantifiable.

#### Figure 1: Chromatogram of Fortified Blended Flour at 50 µg/kg

آمر		lenol								100				Į	Ergocorr	ine.	, Er	gocornin	ine
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
	Pat	ulin								. al						HT-2			
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
	ometrine		metrinine		0.00	0.00	1.00	0.00	0.00	1003					Fumon	icin B3	. Fumo	onisin B2	
ð	Λ.,	A.,		~						-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00		1.00	2.00	3.00	4.00			7.00		
8		eoxyniv)	alenol							100					Ergocr	A		Ergocryp	
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
્રશ્		A Eus	arenon-)	¢						100					Erg	ocristine		L Ergocri	stinine
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
15	-Acetylde	oxynival	enol,							100						Tentoxir	LA		
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
			. 3-	Acetvide	eoxynival	enol									0	-Zearale	nol.		
8	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
-0.00	1.00	2.00	3.00				7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	0.00		0.00	8.00
100	100 Tenuazonic acid					종]							T-2						
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
~					Altenu	Jene				100						Aflatoxi	in G2		
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
100					14	Alternari	ol			آهر						Afla	itoxin G	1,	
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
-1						Citrinin										Zea	ralenon	e.	
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
					reacina	Ergos	inine							Alte	ernariol i	nonome	thviethe	r .	
-0.00	1.00	2.00	3.00	4.00	fregosine	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	~ <u>\</u> 8.00	9.00
	1.00	2.00	3.00	4.00	5.00		nisin B1	8.00	5.00			2.00	0.00		0.00				0.00
100										100							flatoxin		
-0.00	1.00	2.00	3.00	4.00	5.00		7.00		9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
100						LDiace	toxyscin	penol		100							Aflato	xin B1	
-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
ल्ले					Ergotami	ine 🚛	gotamin	ine		· .							Ochrat	oxin A	
-0.00	1.00	2.00	3.00				7.00		9.00	-0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00

#### **Table 3: Calibration Ranges**

	Baby Whea	at Cereal	Pear	nut	Tomato	Puree	Blended	d Flour
	Linear Range		Linear Range		Linear Range		Linear Range	
Compound	(µg/kg)	r <sup>2</sup>						
Aflatoxin B1	0.4 - 400	0.9996	0.4 - 400	0.9998	0.4 - 400	0.9995	0.4 - 400	0.9998
Aflatoxin B2	0.4 - 400	0.9997	0.4 - 400	0.9998	0.4 - 400	0.9996	0.4 - 400	1.000
Aflatoxin G1	0.4 - 400	0.9999	0.4 - 400	0.9997	0.4 - 400	0.9979	0.4 - 400	1.000
Aflatoxin G2	0.4 - 400	0.9997	0.4 - 400	0.9998	0.4 - 400	0.9993	0.4 - 400	0.9998
Ochratoxin	0.4 - 400	0.9998	0.4 - 400	0.9993	0.4 - 400	0.9996	0.4 - 400	1.000
3-Acetyldeoxynivalenol	4.0 - 400	0.9994	2.0 - 400	0.9997	4.0 - 400	0.9982	2.0 - 400	0.9998
Deoxynivalenol	2.0 - 400	0.9998	4.0 - 400	0.9994	8.0 - 400	0.9991	2.0 - 400	0.9995
Diacetoxyscirpenol	0.8 - 400	0.9998	0.4 - 400	0.9995	0.8 - 400	0.9993	0.4 - 400	0.9998
Fumonisin B1	0.4 - 400	0.9999	0.4 - 400	0.9994	0.4 - 400	0.9999	0.4 - 400	0.9999
Fumonisin B2	0.4 - 400	0.9997	0.4 - 400	0.9997	0.4 - 400	0.9998	0.4 - 400	0.9999
Fumonisin B3	0.4 - 400	0.9999	0.4 - 400	0.9997	0.4 - 400	1.000	0.4 - 400	0.9999
Fusarenon-X	4.0 - 400	0.9971	2.0 - 400	0.9971	8.0 - 400	0.9974	2.0 - 400	0.9995
HT-2	0.4 - 400	0.9999	0.4 - 400	0.9997	0.4 - 400	0.9997	0.4 - 400	0.9999
Nivalenol	-	-	8.0 - 400	0.9990	20 - 400	0.9996	8.0 - 400	0.9997
T-2	0.4 - 400	0.9998	0.4 - 400	0.9998	0.4 - 400	0.9992	0.4 - 400	1.000
α-Zearalenol	4.0 - 400	0.9985	2.0 - 400	0.9992	2.0 - 400	0.9979	2.0 - 400	0.9994
Zearalenone	0.8 - 400	0.9998	0.8 - 400	0.9996	0.8 - 400	0.9995	2.0 - 400	0.9998
Citrinin	0.4 - 400	0.9996	0.4 - 400	0.9986	0.4 - 400	0.9984	0.4 - 400	0.9999
Patulin	4.0 - 400	0.9991	4.0 - 400	0.9995	8.0 - 400	0.9997	4.0 - 400	0.9993
Alternariol	0.4 - 400	0.9998	0.4 - 400	0.9990	4.0 - 400	0.9996	0.4 - 400	0.9997
Alternariol monomethylether	0.4 - 400	0.9996	0.4 - 400	0.9995	0.4 - 400	0.9992	0.4 - 400	0.9999
Altenuene	0.4 - 400	0.9999	0.4 - 400	0.9997	2.0 - 400	0.9999	0.4 - 400	1.000
Tentoxin	2.0 - 400	0.9998	0.4 - 400	0.9998	0.8 - 400	0.9998	0.4 - 400	0.9999
Tenuazonic acid	8.0 - 400	0.9994	2.0 - 400	0.9997	8.0 - 400	0.9987	8.0 - 400	0.9992
Ergocornine	0.4 - 400	0.9999	0.4 - 400	0.9998	0.4 - 400	0.9998	0.4 - 400	0.9999
Ergocorninine	0.4 - 400	0.9998	0.4 - 400	0.9997	0.4 - 400	0.9996	0.4 - 400	0.9999
Ergocristine	0.4 - 400	0.9998	0.4 - 400	0.9998	0.4 - 400	0.9997	0.4 - 400	1.000
Ergocristinine	0.8 - 400	0.9999	0.4 - 400	0.9997	0.4 - 400	0.9990	0.4 - 400	0.9999
Ergocryptine	0.4 - 400	0.9999	0.4 - 400	0.9998	0.4 - 400	0.9998	0.4 - 400	0.9999
Ergocryptinine	0.4 - 400	0.9999	0.4 - 400	0.9997	0.4 - 400	0.9988	0.4 - 400	1.000
Ergometrine	0.4 - 400	0.9998	0.4 - 400	0.9999	0.4 - 400	0.9973	0.4 - 400	0.9999
Ergometrinine	0.4 - 400	0.9997	0.4 - 400	0.9999	0.4 - 400	0.9993	0.4 - 400	0.9999
Ergosine	0.4 - 400	0.9995	0.4 - 400	0.9996	0.4 - 400	0.9996	0.4 - 400	0.9999
Ergosinine	0.4 - 400	0.9999	0.4 - 400	0.9997	0.4 - 400	0.9998	0.4 - 400	0.9997
Ergotamine	0.4 - 400	0.9998	0.4 - 400	0.9998	0.4 - 400	0.9995	0.4 - 400	0.9999
Ergotaminine	0.4 - 400	0.9999	0.4 - 400	0.9997	0.4 - 400	0.9998	0.4 - 400	0.9998

#### Table 4: Recovery & Precision

Compounds	Retention time (min)	Precusor Ion	Product ion 1	Product ion 2
Aflatoxin B1	8.20	313.2 [M+H]+	241.1	284.9
Aflatoxin B2	7.81	315.1 [M+H]+	287.0	259.0
Aflatoxin G1	7.62	329.1 [M+H]+	199.7	243.0
Aflatoxin G2	7.15	331.2 [M+H]+	189.0	313.0

Table 2: MS Tra	issuon and	Recentio	minne	e		Average Recovery (RSD, %)											
	1	,	<u> </u>	· · · · · · · · · · · · · · · · · · ·		Baby Wheat Cereal				Peanut		Tomato Puree			Blended Flour		
Compounds	Retention time (min)	Precusor Ion	Product ion 1	Product ion 2	Concentration, µg/kg	5	50	200	5	50	200	5	50	200	5	50	200
Aflatoxin B1	8.20	313.2 [M+H]+	241.1	284.9	Aflatoxin B1	105 (4.8)	100 (3.0)	79.8 (2.6)	98.2 (6.4)	97.0 (5.2)	89.0 (5.7)	92.7 (3.8)	97.6 (5.2)	103 (3.0)	101 (2.8)	95.5 (1.3)	89.0 (1.
Aflatoxin B2	7.81	315.1 [M+H]+	287.0	259.0	Aflatoxin B2	110 (1.4)	109 (2.8)	106 (2.3)	102 (5.8)	99.3 (4.7)	91.3 (2.9)	91.7 (4.2)	93.3 (0.9)	94.7 (0.4)	100 (2.3)	101 (0.9)	88.7 (1.3
Aflatoxin G1	7.62	329.1 [M+H]+	199.7	243.0	Aflatoxin G1	105 (6.1)	107 (1.7)	102 (2.1)	98.2 (4.2)	97.3 (3.2)	91.2 (4.1)	91.3 (1.9)	92.2 (3.6)	93.3 (2.5)	99.3 (1.7)	100 (1.6)	93.6 (2.)
Aflatoxin G2	7.15	331.2 [M+H]+	189.0	313.0	Aflatoxin G2	108 (3.0)	109 (1.3)	104 (2.2)	104 (5.3)	102 (3.8)	93.5 (1.9)	86.8 (8.3)	96.4 (2.5)	98.5 (2.5)	98.7 (3.1)	102 (2.6)	94.5 (2.0
Ochratoxin A	8.31	404.1 [M+H]+	239.0	358.0	Ochratoxin A	109 (1.8)	108 (2.1)	94.5 (1.5)	102 (1.9)	101 (1.1)	97.7 (0.9)	90.9 (3.5)	93.8 (3.3)	101 (5.9)	98.1 (1.6)	98.2 (1.3)	82.8 (1.
3-Acetyldeoxynivalenol	3.21	339.2 [M+H]+	213.1	231.1	3- + 15-Acetyldeoxynivalenol	104 (6.3)	108 (1.8)	104 (3.3)	101 (6.5)	95.9 (5.8)	91.0 (4.4)	91.9 (4.3)	98.1 (2.7)	95.0 (1.8)	98.4 (5.2)	101 (2.9)	100 (0.9
L5-Acetyldeoxynivalenol	3.14	339.2 [M+H]+	137.1	321.2	Deoxynivalenol	112 (4.0)	102 (2.6)	95.7 (1.3)	98.1 (3.5)	93.7 (4.8)	88.2 (3.4)	-	90.3 (6.4)	94.5 (2.6)	102 (3.5)	97.5 (2.6)	96.9 (0.
Deoxynivalenol	1.30	297.2 [M+H]+	231.0	249.0	Diacetoxyscirpenol	105 (4.0)	107 (1.5)	103 (1.2)	93.2 (4.3)	95.4 (3.9)	93.8 (5.0)	90.9 (3.8)	94.5 (4.7)	94.0 (1.9)	98.1 (6.3)	101 (3.1)	98.7 (1.
Diacetoxyscirpenol	5.73	384.2 [M+H]+	247.1	307.2	Fumonisin B1	94.3 (4.6)	94.0 (2.8)	92.3 (2.6)	87.2 (3.1)	88.2 (4.5)	87.8 (6.6)	91.8 (3.6)	91.5 (1.9)	91.9 (0.7)	100 (3.2)	99.6 (1.7)	96.1 (1.
umonisin B1	5.63	722.5 [M+H]+	352.3	334.2	Fumonisin B2	93.3 (4.1)	95.1 (4.8)	90.3 (2.9)	95.4 (4.7)	92.5 (2.3)	88.8 (3.9)	89.9 (4.1)	92.9 (2.3)	92.4 (0.8)	100 (3.2)	99.6 (1.7)	94.4 (1.
<sup>-</sup> umonisin B2	6.68	706.4 [M+H]+	336.2	318.3	Fumonisin B3	91.8 (4.9)	93.1 (4.8) 94.6 (4.9)	90.3 (2.9) 91.6 (3.1)	90.6 (2.7)	92.3 (2.3) 90.1 (3.8)	88.8 (3.9) 87.7 (4.7)	91.1 (3.6)	92.9 (2.3) 93.1 (1.8)	92.4 (0.8) 91.9 (0.9)	104 (2.7)	99.0 (1.4) 99.9 (1.4)	94.4 (1. 95.9 (1.
Fumonisin B3	6.32	706.4 [M+H]+	336.2	318.3							. ,						
-usarenon-X	1.98	355.1 [M+H]+	137.1	247.1	Fusarenon-X	99.0 (3.9)	100 (2.9)	103 (2.8)	86.9 (7.0)	90.3 (11.0)	88.3 (10.1)	-	92.0 (6.8)	94.3 (1.9)	101 (3.8)	100 (3.7)	98.3 (1.
IT-2	6.20	447.2 [M+Na]+	345.1	285.1	HT-2	110 (2.4)	111 (1.4)	108 (1.1)	100 (2.7)	100 (2.0)	94.3 (3.0)	96.8 (3.1)	96.1 (2.1)	99.0 (1.4)	101 (1.6)	103 (2.2)	98.3 (1.
livalenol	0.92	295.1 [M-H <sub>2</sub> O]+	137.1	91.0	Nivalenol	-	-	-	-	98.3 (6.2)	89.0 (3.6)	-	92.5 (4.5)	93.7 (5.0)	-	95.5 (4.7)	92.9 (2.
-2	7.14	489.2 [M+Na]+	387.1	245.1	T-2	111 (2.1)	110 (1.8)	108 (2.8)	99.1 (2.7)	101 (1.7)	95.9 (2.1)	92.0 (6.3)	94.7 (1.3)	98.6 (1.5)	102 (1.3)	103 (1.3)	96.9 (1
x-Zearalenol	6.96	303.1 [M-H <sub>2</sub> O]+	285.1	175.0	α-Zearalenol	100 (4.9)	102 (5.2)	90.1 (5.8)	89.2 (8.1)	93.6 (5.5)	94.7 (3.4)	97.7 (3.2)	88.9 (4.2)	90.0 (3.4)	96.9 (3.7)	99.0 (3.6)	95.0 (3
Zearalenone	7.65	319.2 [M+H]+	283.1	187.0	Zearalenone	110 (6.7)	110 (3.0)	105 (3.7)	98.3 (7.3)	97.4 (2.8)	91.3 (1.5)	95.0 (4.5)	93.6 (2.2)	95.7 (2.0)	101 (3.8)	102 (2.1)	92.3 (1.
Citrinin	5.43	251.2 [M+H]+	233.1	205.1	Citrinin	26.1 (9.2)	26.6 (3.1)	30.1 (3.8)	24.1 (8.7)	25.1 (1.9)	25.8 (3.5)	71.9 (4.7)	76.4 (1.6)	77.1 (1.7)	32.3 (3.5)	32.2 (6.3)	35.8 (4.
Patulin	1.03	155.0 [M+H]+	99.0	81.0	Patulin	106 (4.6)	95.6 (5.6)	89.2 (5.1)	88.8 (12.0)	83.6 (9.0)	86.0 (7.2)	-	98.9 (3.6)	103 (4.5)	93.6 (4.4)	86.1 (3.1)	92.2 (2.
Alternariol	5.30	259.0 [M+H]+	185.1	130.0	Alternariol	108 (4.1)	108 (1.6)	104 (1.0)	94.2 (3.4)	95.4 (2.4)	96.2 (2.7)	89.3 (4.6)	91.8 (2.5)	91.4 (1.3)	98.4 (2.3)	101 (2.5)	96.3 (3.
Alternariol monomethylether	7.69	273.0 [M+H]+	199.1	128.0	Alternariol monomethylether	108 (4.1)	109 (2.2)	99.3 (2.7)	93.5 (3.3)	93.5 (3.7)	89.8 (2.4)	91.3 (6.6)	88.7 (5.1)	93.9 (3.9)	104 (2.9)	101 (1.7)	93.7 (1.
Altenuene	4.70	293.2 [M+H]+	257.1	275.2	Altenuene	110 (2.1)	109 (2.1)	105 (2.1)	99.6 (2.0)	99.5 (1.2)	95.4 (1.2)	98.4 (3.4)	92.4 (2.1)	92.8 (1.8)	101 (2.9)	101 (3.1)	98.2 (0.
Tentoxin	6.70	415.2 [M+H]+	312.2	302.2	Tentoxin	111 (3.6)	109 (2.5)	103 (1.4)	104 (2.9)	101 (1.1)	95.3 (1.4)	92.5 (6.2)	94.2 (2.2)	95.8 (1.4)	104 (4.2)	105 (2.1)	98.2 (1.
Tenuazonic acid	4.22	198.1 [M+H]+	125.0	153.1	Tenuazonic acid	-	85.8 (1.7)	87.4 (6.3)	92.5 (4.7)	91.0 (2.1)	88.5 (2.4)	-	89.3 (4.1)	88.5 (2.0)	-	92.5 (8.8)	90.0 (9.
Ergocornine	6.03	562.4 [M+H]+	268.2	223.2	Ergocornine	109 (1.5)	109 (1.4)	102 (1.3)	93.8 (3.5)	93.2 (4.4)	91.2 (3.3)	91.5 (3.0)	93.1 (1.9)	92.9 (0.6)	102 (2.5)	101 (1.9)	97.6 (1.
Ergocorninine	7.07	562.4 [M+H]+	268.2	223.2	Ergocorninine	109 (3.0)	109 (2.0)	101 (1.9)	105 (3.0)	104 (2.4)	99.5 (3.1)	89.9 (3.8)	92.3 (2.2)	92.5 (3.1)	101 (2.5)	102 (2.6)	95.7 (2.
Ergocristine	6.56	610.4 [M+H]+	223.2	592.4	Ergocristine	108 (3.1)	108 (2.9)	101 (4.4)	92.1 (3.8)	91.7 (5.1)	92.0 (2.2)	91.3 (2.9)	94.2 (2.0)	94.3 (0.8)	101 (1.7)	99.8 (2.0)	96.7 (1.
Ergocristinine	7.53	576.4 [M+H]+	223.2	592.4	Ergocristinine	106 (3.5)	105 (1.4)	101 (0.8)	102 (4.8)	104 (4.3)	102 (4.6)	91.6 (5.9)	94.4 (1.8)	95.6 (2.7)	102 (2.9)	102 (3.0)	99.3 (4.
Ergocryptine	6.32	576.4 [M+H]+	268.2	223.2	Ergocryptine	107 (2.0)	109 (1.9)	104 (3.4)	95.0 (3.0)	94.7 (4.1)	92.1 (1.7)	90.1 (3.0)	93.5 (2.2)	93.2 (0.7)	99.5 (2.7)	99.9 (1.2)	97.4 (1
rgocryptinine	7.31	576.4 [M+H]+	268.2	223.2	Ergocryptinine	106 (1.7)	108 (2.0)	101 (1.1)	103 (5.3)	105 (4.0)	101 (4.2)	91.1 (4.3)	95.1 (1.5)	98.1 (1.6)	101 (2.0)	101 (1.8)	95.4 (1
irgometrine	1.27	326.2 [M+H]+	223.2	208.1	Ergometrine	92.8 (7.3)	90.0 (4.2)	88.3 (3.6)	101 (2.3)	96.2 (2.6)	86.7 (1.9)	90.7 (3.6)	88.9 (6.1)	87.6 (3.5)	101 (1.8)	99.7 (3.2)	95.3 (1
rgometrinine	1.83	326.2 [M+H]+	223.2	208.1	Ergometrinine	101 (4.2)	99.1 (1.9)	94.3 (0.7)	93.2 (4.3)	95.5 (1.7)	89.1 (2.2)	90.6 (3.9)	90.1 (4.4)	89.7 (1.9)	100 (3.5)	98.5 (1.9)	91.1 (1
irgosine	5.47	548.4 [M+H]+	208.1	223.2	<b>U</b>				90.8 (2.0)	91.8 (2.2)		90.0 (3.9) 91.7 (2.2)					91.1 (1 98.2 (1
irgosinine	5.67	548.4 [M+H]+	208.1	223.2	Ergosine	108 (2.6)	106 (5.6)	101 (3.2)			89.2 (2.6)		90.4 (3.1)	90.3 (1.5)	99.9 (2.7)	99.1 (3.0)	
Ergotamine	5.90	582.4 [M+H]+	223.2	268.2	Ergosinine	111 (1.8)	109 (0.9)	103 (1.1)	100 (1.1)	102 (2.0)	97.7 (2.2)	92.7 (1.4)	93.6 (2.5)	93.8 (0.9)	99.2 (2.8)	98.4 (2.8) 100 (2.1)	97.5 (1.
Ergotaminine	6.13	582.4 [M+H]+	223.2	268.2	Ergotamine	109 (1.9)	108 (1.7)	102 (2.8)	91.0 (2.8)	92.6 (2.8)	89.8 (3.6)	91.1 (2.2)	90.6 (3.7)	90.7 (1.3)	101 (2.9)	100 (3.1)	96.4 (2.
Ligotaminic	0.15	J02.7 [IVI 11]	223.2	200.2	Ergotaminine	109 (1.0)	109 (0.7)	101 (0.6)	98.2 (2.0)	101 (1.5)	96.6 (1.3)	93.6 (3.5)	94.7 (1.7)	94.5 (0.6)	101 (2.3)	99.7 (1.3)	97.1 (1.

local grocery stores. Baby wheat cereal and tomato puree were used as their original forms. Raw peanut was grinded and stored in the refrigerator. A blended flour was prepared by mixing white rice flour (75%), brown rice flour (5%), millet flour (5%), oat flour (5%), all-purpose wheat flour (5%), and allpurpose gluten free flour (5%) with a handheld blender.

#### Conclusions

A workflow was established in this study to provide a unique solution for simultaneous determination of *Alternaria* toxins, ergot alkaloid epimers, and other major mycotoxins produced by fungal genus of Aspergillus, Fusarium, and Penicillum. The reported method was rugged, accurate, and precise using a combination of convenient sample preparation procedure and a fast 11-minute chromatographic analysis. Most importantly, this solution could be applied to multi-mycotoxin quantification in a wide variety of food products.

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