Chemical profile and pancreatic lipase inhibitory activity of *Sinobambusa tootsik (Sieb.) Makino* leaves

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Background. *Sinobambusa tootsik (Sieb.) Makino* (*S. tootsik*) is one species of bamboo distributed in China, Japan and Vietnam. The chemical profile of its leaves and its potential application was unknown yet.

Methods. The chemical profile of *S. tootsik* was studied by HPLC and UPLC-DAD-QTOF-MS. The *S. tootsik* extract was prepared by extraction with 50% ethanol, followed by H103 resins adsorption and desorption processes. Pancreatic lipase inhibitory activity was determined using *p*-nitrophenyl palmitate as the substance, which was hydrolyzed by lipase to form coloured *p*-nitrophenol.

Results. Eighteen compounds were identified in *S. tootsik*. Most of them were the C-glycosylated derivatives of luteolin and apigenin, such as isoorientin, isoorientin-2''-O-rhamnoside and isovitexin. Isoorientin-2''-O-rhamnoside was the most dominant flavonoid in the sample. *S. tootsik* extract was prepared through resin adsorption/desorption with yield of 1.12±015% and total flavonoids content of 8.2±0.2% (in term of isoorientin). The extract exhibited pancreatic lipase inhibitory activity with IC50 value of 0.93 mg/ml.

Conclusion. The chemical profile of *S. tootsik* leaves was uncovered for the first time. C-glycosyl flavonoids were the main constituents in the plant. The extract exhibited pancreatic lipase inhibitory activity and may have potential to be used as food supplement for obesity controlling.

Chemical Profile and Pancreatic Lipase Inhibitory Activity of *Sinobambusa tootsik (Sieb.) Makino* leaves

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ABSTRACT

Background. *Sinobambusa tootsik (Sieb.) Makino* (*S. tootsik*) is one species of bamboo distributed in China, Japan and Vietnam. The chemical profile of its leaves and its potential application was unknown yet.

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Discussion. The chemical profile of *S. tootsik* leaves was uncovered for the first time. C-glycosyl flavonoids were the main constituents in the plant. The extract exhibited pancreatic lipase inhibitory activity and may have potential to be used as food supplement for obesity controlling.

Keywords: *Sinobambusa tootsik (Sieb.) Makino*; chemical profile; C-glycosyl flavonoids;

32 pancreatic lipase; inhibition

33

INTRODUCTION

Bamboo is a valuable plant distributed all over the world with more than 1500 species. The bamboo shoots of some species, e.g. *Phyllostachys heterocycla* cv. *pubescens* (*P. heterocycla*), were eaten as vegetable, while the leaves were used as herbal material in China. The flavonoids extract of some bamboo species were approved as the food antioxidant and food resources in China (Wang et al., 2012a). The pharmacological activities of bamboo leaves were arise from the presence of phytochemicals. For instance, five C-Glycosyl flavones were isolated from Fargesia robusta (Van Hoyweghen et al., 2010). Three chlorogenic acid derivatives were isolated from Phyllostachys edulis and the antioxidant activity was evaluated (Kweon et al., 2001). Wang et al. isolated three isoorientin derivatives from Bambusa. textilis McClure (Wang et al., 2012a). Previous, we identified twelve compounds in the leaves of *Bambusa multiplex cv. Fernleaf* (*B. multiplex*), and found that C-glycosyl flavonoids including vitexin, isovitexin, isoorientin and its derivatives, are the main chemical constitutes of the plant (Qiu & Zhang, 2019). *Sinobambusa tootsik (Sieb.) Makino* (*S. tootsik*) is one species of bamboo distributed in China, Japan and Vietnam. To the best of our knowledge, the chemical profile of its leaves has not been studied yet. To further uncover its potential application, the chemical composition of *S. tootsik* was studied by HPLC and UPLC-QTOF-MS in the present study. Furthermore, the pancreatic lipase inhibition activity of its extract was studied.

Biological names in italics

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MATERIALS AND METHODS

Chemicals and Plant materials

73 **UPLC-DAD-QTOF-MS analysis**

74 The chemical identification was performed on a QTOF 5600-plus mass spectrometer equipped
75 with Turbo V sources and a Turbolonspray interface (AB Sciex Corporation, Foster City, CA,
76 USA) coupled to a Shimadzu LC-30A UPLC-DAD system (Shimadzu Corporation, Kyoto,
77 Japan). Acquity UPLC BEH C18 column (2.1 mm × 100 mm, 1.7 μm, Waters） was used. The
78 flow rate was 0.3 mL/min with injection volume of 1 μL and column temperature of 40 °C. The
79 mobile phase was acetonitrile (A) and 0.1% formic acid aqueous solution (B) using a linear
80 gradient program of 0-30min, 5-40% (A). The mass spectrometer was operated in the negative
81 ion mode. Ultrapure nitrogen was used as the ion source gas 1 (50 psi), ion source gas 2 (50 psi),
82 and curtain gas (40 psi). The Turbo Ion Spray voltage and temperature were set at -4500 V and
83 500 °C, respectively. Declustering potential, collision energy, and collision energy spread were
84 set at 100 V, -40 V, and 10 V, respectively. Data acquisition was performed with Analyst 1.6
85 software (AB Sciex).

86 **HPLC quantification Analysis**

87 The HPLC Analysis was performed on an Agilent 1260 HPLC system equipped with an
88 autosampler and DAD detector. A Symmetry C18 column (250 mm × 4.6 mm i.d., 5 μm; Waters,
89 USA) was used as the stationary phase. The mobile phase consisted of acetonitrile (A) and 0.1%
90 acetic acid aqueous solution (B). The flow rate was 1 mL/min with linear gradient program of 0-
91 30 min, 1-40% A; 30-35 min, 40% A. Detected wavelength was 349 nm with injection volume
92 of 10 μL and column temperature of 40 °C.

progress in our Lab.

CONCLUSION

The chemical profile of *S. tootsik* was studied by HPLC and UPLC-DAD-QTOF-MS. Eightteen compounds were identified, most of them were the C-glycosylated derivatives of luteolin and apigenin, such as isoorientin, isoorientin-2"-O-rhamnoside and isovitexin. Isoorientin-2"-O-rhamnoside was the most dominant flavonoid in the sample. *S. tootsik* extract was prepared through resin adsorption/desorption with yield of 1.12±015% and total flavonoids content of 8.2±0.2% (in term of isoorientin). The extract exhibited pancreatic lipase inhibitory activity with IC50 value of 0.93 mg/ml.

Funding

This work was supported by the National Natural Science Foundation of China (Grant Number 31760461).

Competing Interests

The authors declare there are no competing interests

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Table 1(on next page)

Table 1 Mass characterizations of main peak in the chromatogram of *Sinobambusa tootsik (Sieb.) Makino* by UPLC-QTOF-MS.

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Peak No.	RT (min)	$[M–H]^-$ (m/z)	Fragment ions (m/z) (% base peak)	Proposed structure	Reference
1	6.10	367.1033	193(45), 134(100), 117(10)	Feruloylquinic acid	Qiu et al., 2018
2	6.97	609.1449	519(25), 489(60), 399(70), 369(100)	Quercetin-3-O-robinobioside	Iswaldi et al., 2011
3	7.60	431.1915	385(15), 205(35), 153(100)	Roseoside	Spínola et al., 2015
4	7.78	519.1707	325(10), 265(33), 223(60), 205(100), 190(55),	Unidentified	
5	8.09	489.159	223(40), 205(100),190(80), 164(27)	Unidentified	
6	8.69	371.098	121(100), 249(45), 231(10)	Unidentified	
7	9.14	563.1393	353(100), 383(65), 443(45), 473(32)	Apigenin 6-C-pentoside-8-C-glucoside	Ozarowski et al., 2018
	9.14	447.0924	327(100), 357(70), 297(55), 285(35)	Isoorientin (luteolin 6-C-glucoside)	Figueirinha et al., 2008
8	9.26	593.1504	298(100), 473(85), 327(55), 309(40), 357(35), 429(25)	Isoorientin-2"-O-rhamnoside	Ibrahim et al., 2015
9	9.78	613.213	181(100), 387(85), 166(30),205(25),399(20)	Unidentified	
10	10.68	533.128	353(100), 383(90), 443(50), 473(40), 365(25), 297(23)	Apigenin 6, 8-di-C-pentoside	Ozarowski et al., 2018
	10.68	577.1546	293(100), 413(35), 323(15), 311(15), 457(10),	Isovitexin-2"-O-rhamnoside	Ibrahim et al., 2015
	10.71	431.0986	311(100), 341(35), 283(75)	Isovitexin (apigenin 6-C-glucoside)	Ibrahim et al., 2015
11	11.27	607.1649	323(100), 443(40),308(20),341(15)	Isoscoparin-O-deoxyhexoside	Ozarowski et al., 2018
	11.29	447.091	285(100))	Kaempferol-O-glucoside	Singh et al., 2011
12	12.89	561.1595	561(100), 457(30), 399(14), 337(18), 295(40)	Chrysin 6-C-deoxyhexoside-7-O-glucoside	Ozarowski et al., 2018

	13.01	637.1759	329(100), 314(15), 299(10)	3 ,4 -Dihydroxy-5,6-dimethoxy -7-O-rutinoside flavone	Han et al., 2007
13	13.41	547.1446	293(100), 383(85),341(35), 311(28)	Apigenin 6-C-[2"-O -deoxyhexoside] - pentoside	Ozarowski et al., 2018
14	13.69	577.1546	311(100),415(50),397(15)	Apigenin-6-C-deoxyhexoside-7-O-glucoside	Ozarowski et al., 2018
15	14.08	575.1392	325(100), 297(100), 411(100), 337(70), 285(70), 367(55)	"X"-O-Rhamnosyl C-(6-deoxy -pento-hexos-ulosyl) luteolin	Figueirinha et al., 2008
16	14.45	577.1549	311(100), 298(70), 415(70), 473(50), 327(35)	Apigenin-8-C-deoxyhexoside-7 -O-glucoside	Ozarowski et al., 2018
17	15.52	559.1441	457(10), 395(95), 321(100), 309(25), 293(50), 281(30), 269(60)	Apigenin-8-C-[6-deoxy-2-O-rhamnosyl]-xylo-Hexos-3-uloside	Bezerra et al., 2016
18	16.00	589.1554	425(100),351(65),325(35),299(35)	Unidentified	

Figure 1(on next page)

Figure 1 HPLC chromatogram of *S. tootsik* extract before (a) and after (b) resin purification.

Peaks: 1, Isoorientin-2''-O-rhamnoside; 2, *Isoorientin; 3,* Isovitexin-2''-O-rhamnoside; 4, Isoscoparin-O-deoxyhexoside; 5, Apigenin 6-C-[2"-O-deoxyhexoside]-pentoside.

Figure 1

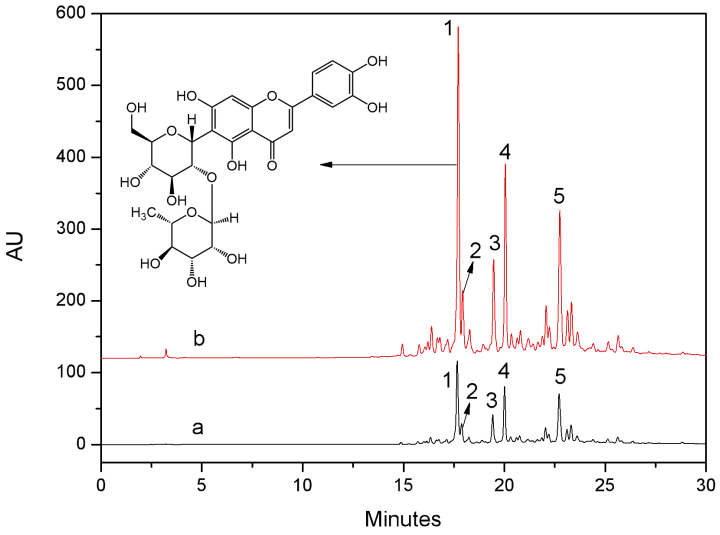

600
500
400
300
200
100
0
AU
0
5
10
15
20
25
30
Minutes
1
2
3
4
5
b
a
OH
HO
H
O
H3C

Figure 2(on next page)

Figure 2 The lipase inhibitory activity of *S. tootsik* extract.

Figure 2

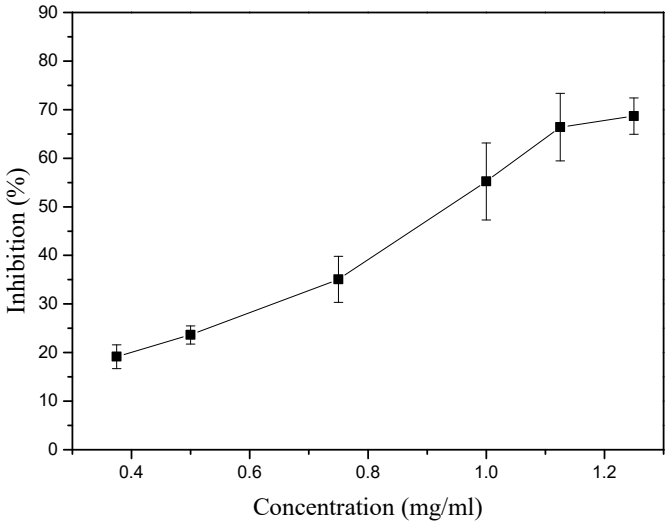

Inhibition (%)
Concentration (mg/ml)
0
10
20
30
40
50
60
70
80
90
0.4
0.6
0.8
1.0
1.2

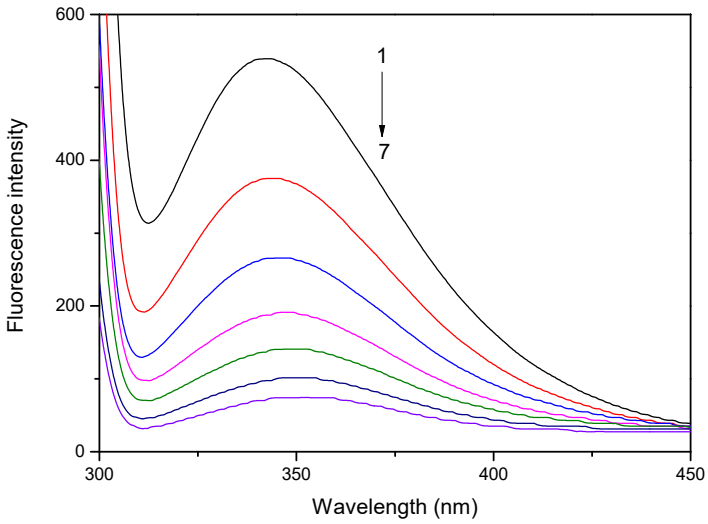
Figure 3(on next page)

Figure 3 The effect of *S. tootsik* extract on fluorescence emission spectra of pancreatic lipase.

The concentrations of *S. tootsik* extract from 1-7 were 0, 10, 20, 30, 40, 50, 60 μg/mL, respectively.

1 Figure 3

2



3

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