frontiers | Frontiers in Pharmacology

TYPE Correction
PUBLISHED 05 January 2023
DOI 10.3389/fphar.2022.1081523

Check for updates

OPEN ACCESS

EDITED AND REVIEWED BY
Li Wu,
Nanjing University of Chinese Medicine, China

*CORRESPONDENCE
Ziping Jiang,
waterjzp@jlu.edu.cn
Bin Liu,
l_bin@jlu.edu.cn

†These authors have contributed equally to this work

SPECIALTY SECTION
This article was submitted to Inflammation Pharmacology, a section of the journal Frontiers in Pharmacology

RECEIVED 27 October 2022
ACCEPTED 28 November 2022
PUBLISHED 05 January 2023

CITATION
Xia Y, Wang D, Li J, Chen M, Wang D, Jiang Z and Liu B (2023), Corrigendum: Compounds purified from edible fungi fight against chronic inflammation through oxidative stress regulation. *Front. Pharmacol.* 13:1081523. doi: 10.3389/fphar.2022.1081523

Corrigendum: Compounds purified from edible fungi fight against chronic inflammation through oxidative stress regulation

Yidan Xia[1†], Dongxu Wang[2†], Jiaqi Li[1], Minqi Chen[1], Duo Wang[1], Ziping Jiang[1*] and Bin Liu[1*]

[1]Department of Hand and Foot Surgery, The First Hospital of Jilin University, Changchun, China, [2]Laboratory Animal Center, College of Animal Science, Jilin University, Changchun, China

KEYWORDS

chronic diseases, natural compounds, edible fungi, antioxidants, molecular mechanisms

A Corrigendum on
Compounds purified from edible fungi fight against chronic inflammation through oxidative stress regulation

by Xia Y, Wang D, Li J, Chen M, Wang D, Jiang Z and Liu B (2022). Front. Pharmacol. 13:974794. doi: 10.3389/fphar.2022.974794

In the published article, the reference for "Recently, various compounds have been isolated from mushrooms, such as polysaccharides, alkaloids, peptides, terpenoids, and polyphenols (Leong et al., 2021)" was incorrectly written as (Leong et al., 2021). It should be (Homer and Sperry, 2017; Zhou et al., 2020; Kuang et al., 2021; Leong et al., 2021; Zhang et al., 2021).

In the published article, there was an error in **Table 1** as published. The references of Table 1 were incorrect due to our carelessness in proof section. The corrected Table 1 and its caption (Table 1 Antioxidant effects of compounds purified from mushrooms) appear below.

The authors apologize for this error and state that this does not change the scientific conclusions of the article in any way. The original article has been updated.

10.3389/fphar.2022.1081523

TABLE 1 Antioxidant effects of compounds purified from mushrooms.

Mushrooms	Compounds	Name	Antioxidant effects	References
Lepista nuda	Polysaccharide	LNP	Scavenge DPPH and $O_2\cdot^-$	Shu et al. (2019)
Entoloma lividoalbum	Polysaccharide	ELPS	Eliminate ·OH	Maity et al. (2015)
Flammulina velutipes	Polysaccharide	FVPs	Scavenge DPPH, ·OH, and $O_2\cdot^-$	Chen et al. (2019)
Floral mushroom	Polysaccharide	FMPS	Scavenge DPPH and ·OH	Wang et al. (2015)
Auricularia auricula	Polysaccharide	AAP-3-1	Increase the activities of SOD, GSH-PX, and CAT	Qian et al. (2020)
Oyster mushroom	Polysaccharide	Extract	Improve the antioxidant status during ageing	Jayakumar et al. (2007)
Pleurotus ostreatus	Polysaccharide	Extract	Protect against oxidative damage induced by H_2O_2	Barbosa et al. (2020)
Pleurotus djamor	Polysaccharide	Extract	Scavenge DPPH and ·OH	Maity et al. (2021)
Pleurotus eryngii	Polysaccharide	PERP	Scavenge reactive radicals and improve the antioxidant status	Zhang et al. (2021a)
Hohenbuehelia serotina	Polysaccharide	NTHSP-A1	Scavenging abilities of ABTS radical and ·OH radical	Li et al. (2017b)
Maitake	Peptide	Glutathione	Antioxidant property	Kalaras et al. (2017)
Matsutake	Peptide	WFNNAGP	Scavenge ·OH and promote the SOD activity	Li et al. (2021)
Agaricus bisporus	Peptide	MPI	Neutralize free radicals to resist oxidative stress	Kimatu et al. (2017)
Schizophyllum commune	Peptide	Extract	Free radical scavenging activity	Wongaem et al. (2021)
Ophiocordyceps sinensis	Peptide	COP	Scavenge DPPH radical and chelate heavy metal ions	Mishra et al. (2019)
Hericium erinaceus	Peptide	Extract	ABTS, DPPH and NO radical scavenging activities	Sangtitanu et al. (2020)
Agaricus blazei	Peptide	ABp	Change the contents of T-AOC, MDA, CAT, and ROS	Feng et al. (2021)
Pleurotus eryngii	Peptide	PEMP	Scavenge DPPH, ·OH, and $O_2\cdot^-$ radicals	Sun et al. (2017)
Sanghuangporus sanghuang	Polyphenol	Extract	Good cellular antioxidant activities	Zhang et al. (2021b)
Flammulina velutipes	Polyphenol	FFVP	Inhibit the secretion of NO and ROS	Ma et al. (2021)
Phlebopus portentosus	Polyphenol	Extract	DPPH scavenging activity and ferric reducing antioxidant power	Kumla et al. (2021)
Phellinus linteus	Polyphenol	Hispolon	Strong free radical scavenging ability	Sarfraz et al. (2020)
Flammulina velutipes	Polyphenol	FVF	Increase glutathione level and SOD activity and inhibit the accumulation of intracellular ROS	Hu et al. (2016)
Boletus edulis and *Cantharellus cibarius*	Polyphenol	Extract	The aqueous extract showed the strongest antioxidant activity	Fogarasi et al. (2021)
Sanghuangporus baumii	Polyphenol	Extract	Scavenge ·OH, DPPH, and ABTS	Zheng et al. (2021)
Boletopsis leucomelas	P-terphenyl compound	Extract	Effective DPPH scavenging capacity	Sakemi et al. (2021)
T. terrestris and T. vialis	P-terphenyl compound	Extract	Prevent VEGF-induced production of ROS and malondialdehyde	Sonowal et al. (2018)
Hericium erinaceum	Sterol	Extract	Cellular antioxidant activity	Li et al. (2017a)
Pholiota nameko	Protein	PNAP	Scavenge ·OH and DPPH	Zhang et al. (2014)
Sanghuangporus sanghuang	Terpenoid	Extract	Scavenge DPPH and ABTS free radicals	Zhang et al. (2021b)
Paxillus involutus	2,5-diarylcyclopentenone	Extract	Clearing abilities of DPPH, ·OH, and $O_2\cdot^-$	Lv et al. (2021)
Agaricomycetes	Extract	Extract	Significantly increase the activities of SOD, CAT and GSH-Px	Zhang et al. (2019)
Agaricus bisporus	Extract	Extract	Enhance the activities of antioxidant enzymes	Liu et al. (2013a)
Lactarius salmonicolor	Extract	Extract	Show the most potent radical scavenging activity	Athanasakis et al. (2013)
Ramaria flava	Extract	Extract	High DPPH and ·OH radical-scavenging activities	Liu et al. (2013b)

(Continued on following page)

TABLE 1 (***Continued***) **Antioxidant effects of compounds purified from mushrooms.**

Mushrooms	Compounds	Name	Antioxidant effects	References
Chaga	Extract	Extract	Scavenging activity against the ABTS radical cation and DPPH radical.	Lee et al. (2007)
Porodaedalea chrysoloma	Extract	Extract	Possess considerable antioxidant effect	Sarkozy et al. (2020)
Orange coral mushroom	Extract	Extract	Good free radical scavenges and reduce capacities	Aprotosoaie et al. (2017)
Cynomorium coccineum	Extract	Extract	ORAC-PYR assay gives the highest antioxidant value in both cases	Zucca et al. (2013)
Entoloma lividoalbum	Extract	Extract	Possess hydroxyl and superoxide radical-scavenging activities	Maity et al. (2014)
Flammulina velutipes	Extract	Extract	High DPPH radical scavenging activity	Bao et al. (2008)
Pleurotus ostreatus	Extract	Extract	High DPPH and hydrogen peroxide scavenging potential	Udeh et al. (2021)
Agaricus brasiliensis	Extract	Extract	Protect against sepsis by alleviating oxidative and inflammatory response	Navegantes-Lima et al. (2020)

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Aprotosoaie, A. C., Zavastin, D. E., Mihai, C. T., Voichita, G., Gherghel, D., Silion, M., et al. (2017). Antioxidant and antigenotoxic potential of Ramaria largentii Marr & D. E. Stuntz, a wild edible mushroom collected from Northeast Romania. *Food Chem. Toxicol.* 108, 429–437. doi:10.1016/j.fct.2017.02.006

Athanasakis, G., Aligiannis, N., Gonou-Zagou, Z., Skaltsounis, A. L., and Fokialakis, N. (2013). Antioxidant properties of the wild edible mushroom Lactarius salmonicolor. *J. Med. Food* 16 (8), 760–764. doi:10.1089/jmf.2012.0297

Bao, H. N., Ushio, H., and Ohshima, T. (2008). Antioxidative activity and antidiscoloration efficacy of ergothioneine in mushroom (Flammulina velutipes) extract added to beef and fish meats. *J. Agric. Food Chem.* 56 (21), 10032–10040. doi:10.1021/jf8017063

Barbosa, J. R., Mm, S. F., Oliveira, L. C., Lh, S. M., Almada-Vilhena, A. O., Oliveira, R. M., et al. (2020). Obtaining extracts rich in antioxidant polysaccharides from the edible mushroom Pleurotus ostreatus using binary system with hot water and supercritical CO2. *Food Chem.* 330, 127173. doi:10.1016/j.foodchem.2020.127173

Chen, X., Fang, D., Zhao, R., Gao, J., Kimatu, B. M., Hu, Q., et al. (2019). Effects of ultrasound-assisted extraction on antioxidant activity and bidirectional immunomodulatory activity of Flammulina velutipes polysaccharide. *Int. J. Biol. Macromol.* 140, 505–514. doi:10.1016/j.ijbiomac.2019.08.163

Feng, Q., Li, Y., Lu, X., Yu, Y., Yuan, G., Sun, J., et al. (2021). Agaricus blazei polypeptide exerts a protective effect on D-galactose-induced aging mice via the Keap1/Nrf2/ARE and P53/Trim32 signaling pathways. *J. Food Biochem.* 45 (1), e13555. doi:10.1111/jfbc.13555

Fogarasi, M., Socaciu, M. I., Salagean, C. D., Ranga, F., Farcas, A. C., Socaci, S. A., et al. (2021). Comparison of different extraction solvents for characterization of antioxidant potential and polyphenolic composition in boletus edulis and cantharellus cibarius mushrooms from Romania. *Molecules* 26 (24), 7508. doi:10.3390/molecules26247508

Homer, J. A., and Sperry, J. (2017). Mushroom-Derived indole alkaloids. *J. Nat. Prod.* 80 (7), 2178–2187. doi:10.1021/acs.jnatprod.7b00390

Hu, Q., Yu, J., Yang, W., Kimatu, B. M., Fang, Y., Ma, N., et al. (2016). Identification of flavonoids from Flammulina velutipes and its neuroprotective effect on pheochromocytoma-12 cells. *Food Chem.* 204, 274–282. doi:10.1016/j.foodchem.2016.02.138

Jayakumar, T., Thomas, P. A., and Geraldine, P. (2007). Protective effect of an extract of the oyster mushroom, Pleurotus ostreatus, on antioxidants of major organs of aged rats. *Exp. Gerontol.* 42 (3), 183–191. doi:10.1016/j.exger.2006.10.006

Kalaras, M. D., Richie, J. P., Calcagnotto, A., and Beelman, R. B. (2017). Mushrooms: A rich source of the antioxidants ergothioneine and glutathione. *Food Chem.* 233, 429–433. doi:10.1016/j.foodchem.2017.04.109

Kimatu, B. M., Zhao, L., Biao, Y., Ma, G., Yang, W., Pei, F., et al. (2017). Antioxidant potential of edible mushroom (Agaricus bisporus) protein hydrolysates and their ultrafiltration fractions. *Food Chem.* 230, 58–67. doi:10.1016/j.foodchem.2017.03.030

Kuang, Y., Li, B., Wang, Z., Qiao, X., and Ye, M. (2021). Terpenoids from the medicinal mushroom antrodia camphorata: Chemistry and medicinal potential. *Nat. Prod. Rep.* 38 (1), 83–102. doi:10.1039/d0np00023j

Kumla, J., Suwannarach, N., Tanruean, K., and Lumyong, S. (2021). Comparative evaluation of chemical composition, phenolic compounds, and antioxidant and antimicrobial activities of tropical black bolete mushroom using different preservation methods. *Foods* 10 (4), 781. doi:10.3390/foods10040781

Lee, I. K., Kim, Y. S., Jang, Y. W., Jung, J. Y., and Yun, B. S. (2007). New antioxidant polyphenols from the medicinal mushroom Inonotus obliquus. *Bioorg. Med. Chem. Lett.* 17 (24), 6678–6681. doi:10.1016/j.bmcl.2007.10.072

Leong, Y. K., Yang, F. C., and Chang, J. S. (2021). Extraction of polysaccharides from edible mushrooms: Emerging technologies and recent advances. *Carbohydr. Polym.* 251, 117006. doi:10.1016/j.carbpol.2020.117006

Li, M., Lv, R., Wang, C., Ge, Q., Du, H., and Lin, S. (2021). Tricholoma matsutake-derived peptide WFNNAGP protects against DSS-induced colitis by ameliorating oxidative stress and intestinal barrier dysfunction. *Food Funct.* 12 (23), 11883–11897. doi:10.1039/d1fo02806e

Li, W., Lee, S. H., Jang, H. D., Ma, J. Y., and Kim, Y. H. (2017a). Antioxidant and anti-osteoporotic activities of aromatic compounds and sterols from hericium erinaceum. *Molecules* 22 (1), 108. doi:10.3390/molecules22010108

Li, X., Wang, L., and Wang, Z. (2017b). Structural characterization and antioxidant activity of polysaccharide from Hohenbuehelia serotina. *Int. J. Biol. Macromol.* 98, 59–66. doi:10.1016/j.ijbiomac.2016.12.089

Liu, J., Jia, L., Kan, J., and Jin, C. H. (2013a). *In vitro* and *in vivo* antioxidant activity of ethanolic extract of white button mushroom (Agaricus bisporus). *Food Chem. Toxicol.* 51, 310–316. doi:10.1016/j.fct.2012.10.014

Liu, K., Wang, J., Zhao, L., and Wang, Q. (2013b). Anticancer, antioxidant and antibiotic activities of mushroom Ramaria flava. *Food Chem. Toxicol.* 58, 375–380. doi:10.1016/j.fct.2013.05.001

Lv, J. H., Yao, L., Zhang, J. X., Wang, L. A., Zhang, J., Wang, Y. P., et al. (2021). Novel 2, 5-diarylcyclopentenone derivatives from the wild edible mushroom paxillus involutus and their antioxidant activities. *J. Agric. Food Chem.* 69 (17), 5040–5048. doi:10.1021/acs.jafc.1c01160

Ma, S., Zhang, H., and Xu, J. (2021). Characterization, antioxidant and anti-inflammation capacities of fermented flammulina velutipes polyphenols. *Molecules* 26 (20), 6205. doi:10.3390/molecules26206205

Maity, G. N., Maity, P., Khatua, S., Acharya, K., Dalai, S., and Mondal, S. (2021). Structural features and antioxidant activity of a new galactoglucan from edible mushroom Pleurotus djamor. *Int. J. Biol. Macromol.* 168, 743–749. doi:10.1016/j.ijbiomac.2020.11.131

Maity, P., Samanta, S., Nandi, A. K., Sen, I. K., Paloi, S., Acharya, K., et al. (2014). Structure elucidation and antioxidant properties of a soluble beta-D-glucan from mushroom Entoloma lividoalbum. *Int. J. Biol. Macromol.* 63, 140–149. doi:10.1016/j.ijbiomac.2013.10.040

Maity, P., Sen, I. K., Maji, P. K., Paloi, S., Devi, K. S., Acharya, K., et al. (2015). Structural, immunological, and antioxidant studies of beta-glucan from edible mushroom Entoloma lividoalbum. *Carbohydr. Polym.* 123, 350–358. doi:10.1016/j.carbpol.2015.01.051

Mishra, J., Rajput, R., Singh, K., Bansal, A., and Misra, K. (2019). Antioxidant-Rich peptide fractions derived from high-altitude Chinese caterpillar medicinal mushroom ophiocordyceps sinensis (ascomycetes) inhibit bacterial pathogens. *Int. J. Med. Mushrooms* 21 (2), 155–168. doi:10.1615/IntJMedMushrooms.2019030013

Navegantes-Lima, K. C., Monteiro, V. V. S., de Franca Gaspar, S. L., de Brito Oliveira, A. L., de Oliveira, J. P., Reis, J. F., et al. (2020). Agaricus brasiliensis mushroom protects against sepsis by alleviating oxidative and inflammatory response. *Front. Immunol.* 11, 1238. doi:10.3389/fimmu.2020.01238

Qian, L., Liu, H., Li, T., Liu, Y., Zhang, Z., and Zhang, Y. (2020). Purification, characterization and *in vitro* antioxidant activity of a polysaccharide AAP-3-1 from Auricularia auricula. *Int. J. Biol. Macromol.* 162, 1453–1464. doi:10.1016/j.ijbiomac.2020.07.314

Sakemi, Y., Hagiwara, M., Oikawa, A., Sato, M., Sato, S., Sawa, N., et al. (2021). Antioxidant p-terphenyl compounds in the mushroom Boletopsis leucomelas (PERS.) FAYOD and how they change via cooking. *Food Chem.* 363, 130281. doi:10.1016/j.foodchem.2021.130281

Sangtitanu, T., Sangtanoo, P., Srimongkol, P., Saisavoey, T., Reamtong, O., and Karnchanatat, A. (2020). Peptides obtained from edible mushrooms: Hericium erinaceus offers the ability to scavenge free radicals and induce apoptosis in lung cancer cells in humans. *Food Funct.* 11 (6), 4927–4939. doi:10.1039/d0fo00227e

Sarfraz, A., Rasul, A., Sarfraz, I., Shah, M. A., Hussain, G., Shafiq, N., et al. (2020). Hispolon: A natural polyphenol and emerging cancer killer by multiple cellular signaling pathways. *Environ. Res.* 190, 110017. doi:10.1016/j.envres.2020.110017

Sarkozy, A., Kusz, N., Zomborszki, Z. P., Csorba, A., Papp, V., Hohmann, J., et al. (2020). Isolation and characterization of chemical constituents from the poroid medicinal mushroom porodaedalea chrysoloma (agaricomycetes) and their antioxidant activity. *Int. J. Med. Mushrooms* 22 (2), 125–131. doi:10.1615/IntJMedMushrooms.2020033698

Shu, X., Zhang, Y., Jia, J., Ren, X., and Wang, Y. (2019). Extraction, purification and properties of water-soluble polysaccharides from mushroom Lepista nuda. *Int. J. Biol. Macromol.* 128, 858–869. doi:10.1016/j.ijbiomac.2019.01.214

Sonowal, H., Shukla, K., Kota, S., Saxena, A., and Ramana, K. V. (2018). Vialinin A, an edible mushroom-derived p-terphenyl antioxidant, prevents VEGF-induced neovascularization *in vitro* and *in vivo*. *Oxid. Med. Cell. Longev.* 2018, 1052102. doi:10.1155/2018/1052102

Sun, Y., Hu, X., and Li, W. (2017). Antioxidant, antitumor and immunostimulatory activities of the polypeptide from Pleurotus eryngii mycelium. *Int. J. Biol. Macromol.* 97, 323–330. doi:10.1016/j.ijbiomac.2017.01.043

Udeh, A. S., Ezebialu, C. U., Eze, E. A., and Engwa, G. A. (2021). Antibacterial and antioxidant activity of different extracts of some wild medicinal mushrooms from Nigeria. *Int. J. Med. Mushrooms* 23 (10), 83–95. doi:10.1615/IntJMedMushrooms.2021040197

Wang, J. H., Xu, J. L., Zhang, J. C., Liu, Y., Sun, H. J., and Zha, X. (2015). Physicochemical properties and antioxidant activities of polysaccharide from floral mushroom cultivated in Huangshan Mountain. *Carbohydr. Polym.* 131, 240–247. doi:10.1016/j.carbpol.2015.05.052

Wongaem, A., Reamtong, O., Srimongkol, P., Sangtanoo, P., Saisavoey, T., and Karnchanatat, A. (2021). Antioxidant properties of peptides obtained from the split gill mushroom (Schizophyllum commune). *J. Food Sci. Technol.* 58 (2), 680–691. doi:10.1007/s13197-020-04582-4

Zhang, C., Song, X., Cui, W., and Yang, Q. (2021a). Antioxidant and anti-ageing effects of enzymatic polysaccharide from Pleurotus eryngii residue. *Int. J. Biol. Macromol.* 173, 341–350. doi:10.1016/j.ijbiomac.2021.01.030

Zhang, J. J., Chen, B. S., Dai, H. Q., Ren, J. W., Zhou, L. W., Wu, S. H., et al. (2021b). Sesquiterpenes and polyphenols with glucose-uptake stimulatory and antioxidant activities from the medicinal mushroom Sanghuangporus sanghuang. *Chin. J. Nat. Med.* 19 (9), 693–699. doi:10.1016/S1875-5364(21)60101-2

Zhang, J. J., Chen, B. S., Dai, H. Q., Ren, J. W., Zhou, L. W., Wu, S. H., et al. (2021). Sesquiterpenes and polyphenols with glucose-uptake stimulatory and antioxidant activities from the medicinal mushroom Sanghuangporus sanghuang. *Chin. J. Nat. Med.* 19 (9), 693–699. doi:10.1016/S1875-5364(21)60101-2

Zhang, J., Zhang, J., Zhao, L., Shui, X., Wang, L. A., and Wu, Y. (2019). Antioxidant and anti-aging activities of ethyl acetate extract of the coral tooth mushroom, hericium coralloides (agaricomycetes). *Int. J. Med. Mushrooms* 21 (6), 561–570. doi:10.1615/IntJMedMushrooms.2019030840

Zhang, Y., Liu, Z., Ng, T. B., Chen, Z., Qiao, W., and Liu, F. (2014). Purification and characterization of a novel antitumor protein with antioxidant and deoxyribonuclease activity from edible mushroom Pholiota nameko. *Biochimie* 99, 28–37. doi:10.1016/j.biochi.2013.10.016

Zheng, N., Ming, Y., Chu, J., Yang, S., Wu, G., Li, W., et al. (2021). Optimization of extraction process and the antioxidant activity of phenolics from sanghuangporus baumii. *Molecules* 26 (13), 3850. doi:10.3390/molecules26133850

Zhou, J., Chen, M., Wu, S., Liao, X., Wang, J., Wu, Q., et al. (2020). A review on mushroom-derived bioactive peptides: Preparation and biological activities. *Food Res. Int.* 134, 109230. doi:10.1016/j.foodres.2020.109230

Zucca, P., Rosa, A., Tuberoso, C. I., Piras, A., Rinaldi, A. C., Sanjust, E., et al. (2013). Evaluation of antioxidant potential of "Maltese mushroom" (Cynomorium coccineum) by means of multiple chemical and biological assays. *Nutrients* 5 (1), 149–161. doi:10.3390/nu5010149