Asian Journal of Chemistry; Vol. 26, No. 10 (2014), 3033-3035

ASIAN JOURNAL OF CHEMISTRY

http://dx.doi.org/10.14233/ajchem.2014.16545

Antioxidant Activity of Monoglucoside-Triarabinoside from the Fruits of *Lycium chinense* Miller

ILL-MIN CHUNG[1], YE-SUL YANG[1], PRAVEEN NAGELLA[1], YOUNG-SUP AHN[2], JUNG -DAE LIM[3], SEUNG-HYUN KIM[1] and ATEEQUE AHMAD[1,*]

[1]Department of Applied Life Science, Konkuk University, Seoul 143-701, Republic of Korea
[2]Department of Herbal Crop Research, NIHHIS, RDA, Eumseong 369-873, Republic of Korea
[3]Department of Herbal Medicine Resources, Kangwon National Universtiy, Samcheok 245-907, Republic of Korea

*Corresponding author: Fax: +82 2 4467856; Tel: +82 2 4503730; E-mail: ateeque97@gmail.com

Received: 18 October 2013; *Accepted*: 16 December 2013; *Published online*: 10 May 2014; AJC-15175

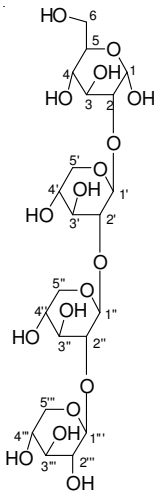
Lycium chinense, a famous Chinese medicinal herb, has long history of use as a traditional remedy for many diseases. One compound as α-D-glucopyranosyl-(2 → 1')-α-L-arabinopyranosyl-(2' → 1")-α-L-arabinopyranosyl-(2" → 1"')-α-L-arabinopyranoside (**1**) was isolated from the butanol fraction of methanol extract of fruits of *L. chinense*. The compound **1** was investigated for scavenging of the diphenylpicrylhydrazyl (DPPH$^{\bullet}$) radical scavenging activity, reducing power and the phosphomolybdenum activity and the results demonstrate that the compound (**1**) has potential as a natural antioxidant.

Keywords: *Lycium chinense*, Solanaceae, Constituent, Antioxidant activity.

INTRODUCTION

Lycium chinense Miller fruits (Fructus Lycii) known as "Gou-Qi-Zi" in Chinese, has long history of application as a valuable tonic and health food supplement for improving vision and maintaining good health. It is reputed to have the properties of nourishing the blood, enriching the yin, tonifying the kidney and liver, moistening the lungs[1,2]. Fruits of *L. chinense* (Solanaceae), distributed in northeast Asia, specially China, Japan, Korea and Taiwan, have been widely used as a tonic in traditional medicine. Numerous physiological and biochemical process in the human body may oxygen centered free radicals and other reactive oxygen species as by products. Over production of such free radicals can cause oxidative damage to biomolecules (*e.g.*, lipids, proteins, *etc*.) eventually leading to many common disease and other degenerative disease in humans. Plants may contain a wide range of free radical scavenging molecules and some other endogenous metabolites, which are rich in antioxidant activity. Antioxidant compounds possess several class of biological activities to greater or lesser extent. The intake of natural antioxidants has been associated with reduce of several diseases in human body[3].

As resources of natural antioxidants much attention have been paid to plants and other organism. *L. chinense* is a famous traditional Chinese herbal medicine which has functions of nourishing the kidney, lever and brighting eyes, reducing blood glucose level and serum lipids, antiaging, immuno-modulating, anticancer, antifatigue[4-10]. The plant was reported to possess antioxidant properties[11]. Evaluation of antioxidant and other activities of compounds from *L. barbarum* and *L. chinense* has been reported[10,12]. This paper describes the three antioxidant activities, 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging, reducing power and the phosphomolybdenum activities of one compound as α-D-glucopyranosyl-(2→1')-α-L-arabinopyranosyl-(2'→1'')-α-L-arabinopyranosyl-(2''→1''')-α-L-arabinopyranoside (**1**) from the fruits of *L. chinense*. Antioxidant activity of monogluco-triarabinoside (**1**) was evident as it showed significant natural antioxidants. The spectroscopic data of compound **1** was already reported in literature[13].



Chemical structure of compound **1**

EXPERIMENTAL

Free radical scavenging activity: The antioxidant activity of the compound (**1**), based on the scavenging activity of the stable 1,1-diphenyl-2-picrylhydrazyl (DPPH•) free radical, was determined by the method described[14]. Different concentrations (1, 2, 3, 4 and 5 mg) of the tested compounds (0.2 mL) were taken in different test tubes with 4 mL of a 0.006 % MeOH solution of DPPH. Water (0.2 mL) in place of the compound was used as control. BHT was used as standard. Absorbance at 517 nm was determined after 30 min of incubation at 37 °C. Radical scavenging activity was expressed as the inhibition percentage and was calculated using the following formula, % Radical scavenging activity = $[(A_0 - A_1)/A_0] \times 100$, where A_0 is the absorbance of the control and A_1 is the absorbance of the compound/standard.

Assay of reductive potential: The reductive potential of the compound (**1**), was determined according to the method[15]. The reaction mixture containing varying concentrations of the compound (1.0-5.0 mg/mL) in 1 mL of distilled water, phosphate buffer (2.5 mL, 0.2 M, pH 6.6) and potassium ferricyanide $[K_3Fe(CN)_6]$ (2.5 mL, 1 %). The mixture was incubated at 50 °C for 20 min. A portion (2.5 mL) of trichloroacetic acid (10 %) was added to the mixture, which was then centrifuged at 1000 rpm for 10 min. The upper layer of the solution (2.5 mL) was mixed with distilled water (2.5 mL) and $FeCl_3$ (0.5 mL, 0.1 %) and the absorbance was measured at 700 nm in a spectrophotometer. BHT was used as the standard. Increased absorbance of the reaction mixture indicated increased reductive potential. All analysis were run in triplicate and averaged.

Evaluation of antioxidant capacity was performed by phosphomolybdenum method. The total antioxidant capacity of the compound (**1**) was evaluated by the known method[16]. An aliquot of 0.1 mL of sample solution (100 µg/mL) was combined with 1 mL of reagent solution (0.6 M sulfuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate). The tubes were capped and incubated in a boiling water bath at 95 °C for 90 min. After the samples had cooled to room temperature, the absorbance of the aqueous solution of each was measured at 695 nm against blank. A typical blank solution contained 1 mL of reagent solution and the appropriate volume of the same solvent used for the sample and it was incubated under same conditions as rest of the sample. The results are expressed as equivalents of α-tocopherol (mg/g of compound).

RESULTS AND DISCUSSION

Free radical scavenging activity: The free radical-scavenging activity of the compound (**1**) was tested through DPPH method[14] and the results were compared with BHT. DPPH is usually used as a substrate to evaluate antioxidative activity of antioxidants. The method is based on the reduction of methanolic DPPH• solution in the presence of a hydrogen donating antioxidant, due to the formation of the non-radical form DPPH-H by the reaction. The compound was able to reduce the stable radical DPPH• to the yellow-colored diphenylpicrylhydrazine. It has been found that cysteine, glutathione, ascorbic acid, tocopherol, polyhydroxy aromatic compounds (*e.g.*, hydroquinone, pyrogallol, gallic acid) and aromatic amines (*e.g.*, *p*-phenylene diamine, *p*-aminophenol), reduce and decolorize 1,1-diphenyl-2-picrylhydrazyl by their hydrogen donating ability[17]. Fig. 1, shows the concentration dependent antioxidant activity of the compound (**1**) at different concentration levels as measured by the DPPH• scavenging assay. The IC_{50} value of the compound was 4.94 mg/mL. The DPPH activity of BHT showed higher degree of free radical-scavenging activity than that of the compound at very low concentration points. The DPPH activity of BHT exhibited 92.04 % at 50 µg/mL concentration with an IC_{50} value of 27 µg/mL (data not shown). Li *et al.*[10], reported that the polysaccharide fraction from the fruits of *Lycium barbarum* exhibited a weak DPPH activity. This is similar to other studies wherein they have reported that only 0.3 mg/mL tocopherol, 0.23 mg/mL BHT and 0.1 mg BHA exhibited a free radical scavenging activity equivalent to 3.9 mg/mL of red bean and 10 mg/mL of sesame coat extract[18,19].

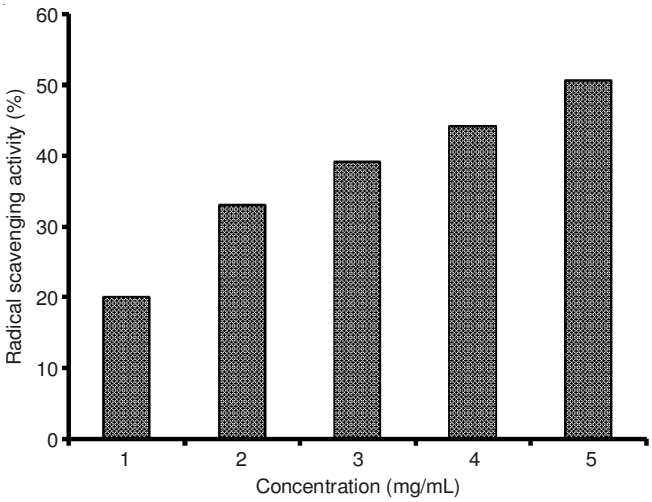


Fig. 1. Antioxidant activity of the compound (1) at different concentration levels as measured by DPPH radical scavenging activity

Reducing power: Antioxidant effect exponentially increases as a function of the development of the reducing power, indicating that the antioxidant properties are concomitant with the development of reducing power[20]. Okuda *et al.*[21], have reported that the reducing power of tannins from medicinal plants prevents liver injury by inhibiting formation of lipid peroxides. Reductones are believed not only to react directly with peroxides but also prevent peroxide formation by reacting with certain precursors. As seen in Fig. 2 reducing power of the compound from the ethyl acetate/methanol extract of lycium fruit increased with increasing concentration from 1 to 5 mg/mL. The activity of BHT was higher than the test samples at each concentration points (Data not shown). This is in line with the observations of several other workers wherein the reducing power of BHT and tocopherol[19] and BHA[22] was higher than the extracts. In the present study, though the compounds from the methanol extract of lycium fruits exhibited a moderate reducing power they did have an activity that reveals that the compounds from the ethyl acetate/methanol extract of lycium fruit are electron donors and can react with free radicals and convert them to stable products thus terminating the free radical chain reactions.

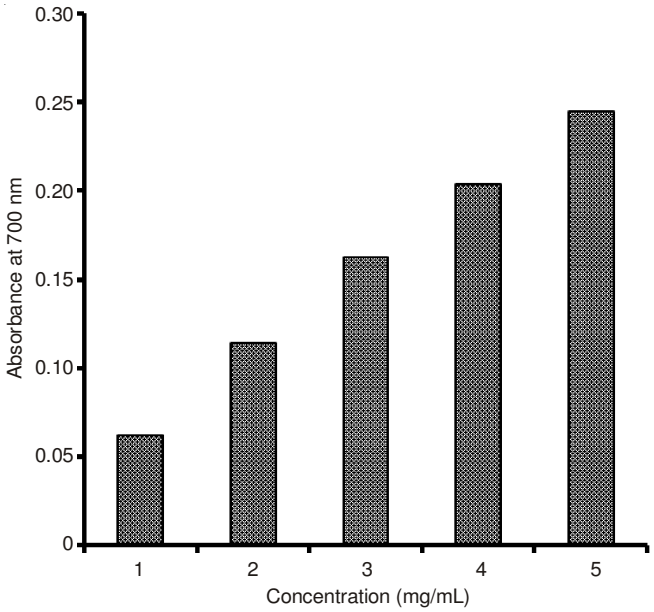


Fig. 2. Reducing power of the compound (**1**) at different concentration levels

Measurement of antioxidant capacity by phosphomolybdenum method: The antioxidant capacity of the compound was measured spectrophotometrically by phosphomolybdenum method, which is based on the reduction of Mo(IV) to Mo(V) by the sample analyte and the subsequent formation of green phosphate/Mo(V) compounds with a maximum absorption at 695 nm. The antioxidant capacity of the compounds was found to be 115.95 mg/g of the extract).

ACKNOWLEDGEMENTS

This work was carried out with the support of Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ 906938), Rural Development Administration, Republic of Korea.

REFERENCES

1. Y. Peng, C. Ma, Y. Li, K.S.Y. Leung, Z.H. Jiang and Z. Zhao, *Plant Foods Hum. Nutr.*, **60**, 161 (2005).
2. Pharmacopoeia of the People's Republic of China, Chemical Industry Press, Beijing (2000).
3. Y. Cai, Q. Luo, M. Sun and H. Corke, *Life Sci.*, **74**, 2157 (2004).
4. X.M. Gao, Z.M. Xu and Z.W. Li, Traditional Chinese Medicines, People's Health Publishing House, Beijing, edn. 3, pp. 1832-50 (2000).
5. X.M. Peng, L.J. Huang, C.H. Qi, Y.Z. Zhang and G.Y. Tian, *Chin. J. Chem.*, **19**, 1190 (2001).
6. X.M. Peng, C.H. Qi, G.Y. Tian and Y.Z. Zhang, *Chin. J. Chem.*, **19**, 842 (2001).
7. J.H. Wang, H.Z. Wang, M. Zhang and S.H. Zhang, *Ying Yang Xue Bao*, **24**, 189 (2002).
8. Y.R. Wang, H. Zhao, X.S. Sheng, P.E. Gambino, B. Costello and K. Bojanowski, *J. Ethnopharmacol.*, **82**, 169 (2002).
9. L. Gan and S.H. Zhang, *Ying Yang Xue Bao*, **25**, 200 (2003).
10. X.M. Li, X.L. Li and A.G. Zhou, *Eur. Polym. J.*, **43**, 488 (2007).
11. C.C. Wang, S.C. Chang, B.S. Inbaraj and B.H. Chen, *Food Chem.*, **120**, 184 (2010).
12. M. Ming, L. Guanhua, Z. Zhanhai, C. Guang and Z. Xuan, *Food Chem.*, **113**, 872 (2009).
13. I.M. Chung, Y.-Seul Yang and A. Ahmad, *Asian J. Chem.*, **26**, 894 (2014).
14. D.R. Katerere and J.N. Eloff, *Phytother. Res.*, **19**, 779 (2005).
15. H.J.D. Dorman and R. Hiltunen, *Food Chem.*, **88**, 193 (2004).
16. P. Prieto, M. Pineda and M. Aguilar, *Anal. Biochem.*, **269**, 337 (1999).
17. M.S. Blois, *Nature*, **181**, 1199 (1958).
18. L.W. Chang, W.J. Yen, S.C. Huang and P.D. Duh, *Food Chem.*, **78**, 347 (2002).
19. Y.-C. Chung, C.-T. Chang, W.-W. Chao, C.-F. Lin and S.-T. Chou, *J. Agric. Food Chem.*, **50**, 2454 (2002).
20. M. Tanaka, W.K. Chiu, Y. Nagashima and T. Taguchi, *Nippon Suisan Gakkai Shi*, **54**, 1409 (1988).
21. T. Okuda, Y. Kimura, T. Yoshida, T. Hatano, H. Okuda and S. Arichi, *Chem. Pharm. Bull. (Tokyo)*, **31**, 1625 (1983).
22. M. Oktay, I. Gülçin and Ö.I. Küfrevioglu, *Lebenson. Wiss. Technol.*, **36**, 263 (2003).