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Antioxidant Potential and Element Contents of Wild Mushroom *Tricholoma imbricatum*

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ABSTRACT

In this study, antioxidant and oxidant levels of wild mushroom *Tricholoma imbricatum* (F.) P. Kumm. were determined. In addition, the levels of Cu, Fe, Ni, Pb and Zn that they accumulated in their body were determined. In this context, antioxidant and oxidant status were determined using TAS and TOS kits. Element contents were measured using atomic absorption spectrometry. As a result of the studies, it was determined that TAS value of *T. imbricatum* was 3.474 ± 0.049, TOS value was 15.257 ± 0.117 and OSI value was 0.439 ± 0.003. Also, it has been determined that the mushroom could be a natural antioxidant source. In addition, it has been observed that the levels of elements accumulated within the fruiting body were at normal levels for wild mushrooms. As a result, it was thought that *T. imbricatum* could be used as a natural agent in pharmacological research because of its antioxidant potential.

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Doğal Mantar *Tricholoma imbricatum*'un Antioksidan Potansiyeli ve Element İçerikleri

ÖZET

Bu çalışmada dogal mantar *Tricholoma imbricatum* (F.) P.Kumm.'un antioksidan ve oksidan seviyeleri belirlenmiştir. Ayrıca bünyesinde biriktirdikleri Cu, Fe, Ni, Pb and Zn seviyeleri tespit edilmiştir. Bu kapsamda antioksidan ve oksidan seviyeleri TAS ve TOS kitleri kullanılarak belirlendi. Element içerikleri atomik absorpsiyon spektrofotometresi kullanılarak ölçülmüştür. Yapılan çalışmalar sonucunda *T. imbricatum*'un TAS değerinin 3.474±0.049, TOS değerinin 15.257±0.117 ve OSI değerinin ise 0.439±0.003 olduğu belirlenmiştir. Bu kapsamda mantarın doğal antioksidan kaynak olabileceği belirlenmiştir. Ayrıca bünyesinde biriktirdiği element seviyelerinin wild mantarlar için normal düzeylerde olduğu görülmüştür. Sonuç olarak *T. imbricatum*'un antioksidan potansiyelinden dolayı farmakolojik araştırmalarda doğal ajan olarak kullanılabileceği düşünülmektedir.

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INTRODUCTION

Mushrooms have long been considered a delicious, nutritious food product consumed by different communities around the world. In ancient beliefs, according to the Egyptians, it was seen as the "Gift of God" and according to the Chinese, it is seen as the "Elixir of Life". In addition, they have accepted the mushrooms as an insidious poison by the societies for centuries and they have been very frightened in mushroom consumption (Sevindik et al., 2018a; Fakoya et al., 2020). In countries where wild mushrooms are dense, consumption is high. In addition to their nutritional value, many edible mushrooms have long been used for medicinal purposes. It has also gained significant medical use in many inedible species. Today, there are at least 270 species of fungi that are known to have various therapeutic properties (Ying et al., 1987; Singh et al., 2020). In studies on mushrooms, it has been reported to be antioxidant, antitumor, antimicrobial, anti-aromatase activity, anti-inflammatory activity, free-radical scavenging activity, antiproliferative activity (Cheung et al., 2003; Ngai et al., 2004; Chen et al., 2006; Zhang et al., 2007; Barros et al., 2007; Moro et al., 2012; Bal et al., 2017; Sevindik et al., 2018b). *Tricholoma imbricatum* (F.) P.Kumm., usually found under Pinus species, is known as scented mushroom in Anatolia (Tel et al., 2012). It is observed as mycorrhizal single or in groups with pine trees. In this study, total antioxidant status, total oxidant status and oxidative

stress index and element contents of *T. imbricatum* mushroom were determined.

MATERIAL and METHOD

Laboratory studies:

Tricholoma imbricata samples were collected from Turkey (Gaziantep/Oğuzeli). 40 grams of mushroom samples were extracted with ethanol (EtOH) for about 6 hours at 50 ° C using a soxhlet apparatus (Gerhardt EV 14). The extracts were concentrated by rotary evaporator (Heidolph Laborota 4000 Rotary Evaporator).

TAS, TOS and OSI Tests:

Rel Assay brand kits were used to determine total antioxidant status (TAS), total oxidant status (TOS) and oxidative stress index (OSI) values of *T. imbricatum* samples. Trolox was used for TAS tests and hydrogen peroxide was used as calibrator for TOS tests (Erel, 2004, 2005). TOS values are proportioned to TAS values and their percentages are taken to determine OSI (Erel, 2005).

Determination of Element Content:

The mushroom samples were dried at 80 ºC in order to determine the heavy metal contents (Cu, Fe, Ni, Pb and Zn) of *T. imbricatum* samples. An amount of 0.5 g of these samples were taken and mineralized in a mixture of 9 mL HNO_3 + 1 mL H_2O_2 in a microwave solubilizer (Milestone Ethos Easy). The heavy metal contents of the mushroom were determined using the atomic absorption spectrophotometer (Agilent 240FS AA) (Sevindik et al., 2016).

RESULT and DISCUSSION

Antioxidant Activity:

Oxidation is important for many organisms for the continuity in biological processes. Continuous production of free radicals leads to cell deaths. As a result of these deaths and cell damages, it causes many diseases such as aging, cancer, diabetes and cirrhosis. Natural antioxidants are needed to prevent chronic diseases (Sarker et al., 2020; Chandra et al., 2020). Therefore, the oxidant and antioxidant potentials of *T. imbricatum* mushroom have been investigated. As a result of the researches, it was determined that TAS value of *T. imbricatum* was 3.474±0.049, TOS value was 15.257±0.117 and OSI value was 0.439±0.003. TAS value of *Suillus granulatus* (L.) Roussel was reported as 3.143, TOS value was 18.933 and OSI value was 0.603 from previous studies (Mushtaq et al., 2020). The TAS value of *Lactifluus rugatus* (Kühner & Romagn.) Verbeken has been reported as 3.237, TOS value was 8.178 and OSI value was 0.254 (Sevindik, 2020). TAS value of *Infundibulicybe geotropa* (Bull.) Harmaja has been reported as 1.854, TOS value was 30.385 and OSI value was 1.639 (Sevindik et al., 2020). TAS value of *Tricholoma virgatum* (Fr.) P. Kumm. has been reported as 3.754, TOS value was 8.362 and OSI value was 0.223 (Selamoglu et al., 2020). TAS value of *Cerioporus varius* (Pers.) Zmitr. & Kovalenko was reported as 2.312, TOS value was 14.358 and OSI value was 0.627 (Sevindik, 2019). TAS value of *Lentinus tigrinus* (Bull.) Fr. has been reported as 1.748, TOS value was 19.294 and OSI value was 1.106 (Sevindik, 2018). Compared to these studies, TAS value of *T. imbricatum* is higher than *S. granulatus, I. geotropa, L. rugatus, C. varius* and *L. tigrinus* and lower than *T. virgatum*. TAS value is an indicator of all antioxidant compounds in the living organisms (Korkmaz et al., 2018). This difference between mushroom species is due to the potential of mushrooms to produce antioxidant compounds. In this context, it is thought that the mushroom can be used as a natural agent in terms of antioxidant compound. TOS value is an indicator of the oxidant compounds produced by the living organisms (Korkmaz et al., 2018). It was determined that TOS value of *T. imbricatum* was lower than *S. granulatus, I. geotropa* and *L. tigrinus*, and higher than *L. rugatus, T. virgatum* and *C. varius*. OSI value shows how much the oxidant compounds in living organisms are suppressed with antioxidant compounds (Korkmaz et al., 2018). It is seen that the oxidant compounds in the body of *T. imbricatum* are better suppressed with antioxidant compounds than *S. granulatus, I. geotropa, C. varius* and *L. tigrinus*. As a result, it is thought that *T. imbricatum* used in this study may be a natural antioxidant source.

Element Contents:

Mushrooms play a role in breaking down organic cover in the ecosystem. Depending on the substrate content they use, they accumulate different levels of elements in their bodies. Some mushroom groups accumulate some elements more in their bodies. With these features, they can be used as element indicators (Borovička and Řanda, 2007; Jiang et al., 2016). In this study, Cu, Fe, Ni, Pb and Zn contents within the body of *T. imbricatum* were determined. The findings obtained are shown in Table 1.

Table 1. Element contents of *T. imbricatum*
Çizelge 1. T. imbricatum'un element içerikleri

Element *Element*	Element contents ($mg.kg^{-1}$) *Element içerikleri*
Fe	516.15±5.63
Zn	63.54±1.48
Cu	34.12±1.52
Pb	7.91±0.55
Ni	1.05±0.14

In previous studies on different types of wild mushrooms, it was reported as 60.33-95 for Cu, 14.6-

835 for Fe, 0.67-5.14 for Ni, 2.86-16.54 for Pb and 29.8-158 for Zn mg.kg^{-1} (Kalač and Svoboda 2000; Zhu et al. 2010; Gebrelibanos et al., 2016; Sevindik et al., 2017; Sevindik et al., 2018c). Compared to these values, it was determined that Fe, Zn, Pb and Ni content of *T. imbricatum* is in the literature ranges. In addition, it is seen that the Cu content is lower than the literature ranges. In this context, it was observed that the element contents of *T. imbricatum* are compatible with the amounts determined in the literature.

CONCLUSION

In this study, antioxidant and oxidant potentials of wild mushroom *T. imbricatum* were determined. As a result of the tests, it has been determined that the mushroom can be used as a natural antioxidant source. In addition, the levels of some elements in the cork were investigated. In this context, it was determined that the element levels were compatible with the literature ranges.

Conflict of Interest

Article author declare that there are no conflicts of interest among them.

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