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A Study on *Paxillus involutus*: Total Antioxidant and Oxidant Potential

Paxillus involutus Üzerine Bir Çalışma: Toplam Antioksidan ve Oksidan Potansiyeli

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Abstract

Total Antioxidant Status (TAS), Total Oxidant Status (TOS) and Oxidative Stress Index (OSI) of the ethanol extract of *Paxillus involutus* mushroom collected from Burdur province (Turkey) were determined with Rel Assay Diagnostics kits. The study findings demonstrated that TAS values of the mushroom ethanol extract was 1.230 ± 0.035 mmol/L, TOS was 7.533 ± 0.102 µmol/L and OSI was 0.613 ± 0.018. Based on these findings, it was determined that *P. involutus* mushroom had antioxidant potential, and thus, medical properties.

Key words: Medical and poisonous mushrooms, Antioxidant, Oxidant, Oxidative stress.

Öz

Bu çalışmada, Burdur ilinden toplanan *Paxillus involutus* mantarının etanol özütleri kullanılarak Toplam Antioksidan Seviyeleri (TAS), Toplam Oksidan Seviyeleri (TOS) ve Oksidatif Stres Indeksleri (OSİ) Rel Assay Diagnostics kitler kullanılarak belirlenmiştir. Çalışma sonucunda bu mantarın etanol özütünün TAS değeri 1,230 ± 0,035 mmol/L, TOS değeri 7,533 ± 0,102 µmol/L ve OSI değeri 0,613 ± 0,018 olarak tespit edilmiştir. Elde edilen sonuçlara göre *P. involutus* mantarının antioksidan potansiyelinin dolayısıyla da tıbbi özelliğinin olduğu belirlenmiştir.

Anahtar kelimeler: Tıbbi ve zehirli mantarlar, Antioksidan, Oksidan, Oksidatif stres.

1. Introduction

The mushrooms can be characterized under three categories: edible, inedible and poisonous (Sümer 2006; Kaşık 2010). Edible mushrooms have been considered as a source of nutrients by humans throughout the history due to their rich vitamin and mineral content as well as the beneficial proteins they contain for human health (Reis et al. 2011a; Metin et al. 2013; Jo et al. 2014; Turfan et al. 2016; Yılmaz et al. 2017; Bal 2018).

Mushrooms such as *Ganoderma lucidum* (Curtis) P. Karst., *Schizophyllum commune* Fr., *Fomitopsis pinicola* (Sw.) P. Karst. and *Trametes versicolor* (L.) Lloyd that are not poisonous but also inedible are used for medical purposes (Hobbs 2005; Orhan and Üstün 2011; Reis et al. 2011b; Cör et al. 2018). Toxic mushrooms can cause serious health problems if consumed by humans (Bresinsky and Besl 1990; Mat 2000; Kaygusuz et al. 2013; Çolak et al. 2017). In the literature, it was reported that mushrooms possess several medical properties such as antioxidant, antiviral, antifungal, antibacterial, hypoglycemic and anticancer potential (Sarıkürkçü et al. 2008; Gürsoy et al. 2010; Ramesh and Pattar 2010; Adotey et al. 2011; Boonsong et al. 2016; Eroğlu et al. 2016; Kaygusuz et al. 2017; Zengin et al. 2017; Gürgen et al. 2018).

Thus, it is very important to analyze mushrooms in order to identify new natural medical sources. In the present study, total antioxidant status, total oxidant status and oxidative stress index were analyzed to determine the antioxidant capacity of *Paxillus involutus* (Batsch) Fr. mushroom ethanol extract collected from Burdur province (Turkey).

2. Materials and Methods

The mushroom samples used in the study were collected in Bucak district (Burdur province/Turkey) in autumn 2017. The morphological and ecological properties of the photographed samples (Fig. 1) were noted. Microscopic characteristics were determined with Congo red and 3% KOH under light microscope. The identification of the samples was conducted using Breitenbach and Kränzlin (1991) and Dähncke (2006). The mushroom samples were dried in an incubator at +40°C and extracted with ethanol (EtOH) in the Soxhlet device (Gerhardt EV 14).

Figure 1. *Paxillus involutus* (ÖFÇ 1330): basidiomata

Obtained extracts were concentrated with a rotary evaporator (Heidolph Laborota 4000 Rotary Evaporator). To determine the TAS, TOS and OSI for *P. involutus* ethanol extracts, commercial Rel Assay Diagnostics kits (Mega Tıp, Gaziantep, Turkey) were used. Trolyx was used as the calibrator in TAS tests and hydrogen peroxide was used as the calibrator in TOS tests (Erel 2004, 2005). OSI value was calculated using the ratio of TAS to TOS and both units were equalized and TOS. When the OSI (arbitrary unit: AU) was calculated, the following formula was used, and the result was indicated as a percentage (Erel 2005). In the study, 6 mushroom samples were tested in 5 repeats.

$$\text{OSI (AU)} = \frac{\text{TOS, } \mu\text{mol } H_2O_2 \text{ equiv./L}}{\text{TAS, mmol Trolox equiv./L} \times 10}$$

3. Results and Discussion

In the present study, *P. involutus* mushroom ethanol extracts were obtained and their antioxidant potential was determined. The results are presented in Tab. 1.

Table 1. TAS, TOS and OSI values of *P. involutus.*

	TAS	TOS	OSI
P. involutus	1.230 ± 0.035	7.533 ± 0.102	0.613 ± 0.018

There is no available data in the literature on *P. involutus* mushroom TAS, TOS and OSI values. However, oxidative stress studies were conducted on different mushroom species.

In these studies, it was determined that the TAS value of *Helvella leucomelaena* (Pers.) Nannf. was 2.367, the TOS value was 55.346 and the OSI value was 2.338 (Sevindik et al. 2018a). The TAS value of *Cyclocybe cylindracea* (DC.) Vizzini & Angelini was determined as 4.325, the TOS value was determined as 21.109 and the OSI value was determined as 0.488 (Sevindik et al. 2018b). The TAS value of *Pholiota limonella* (Peck) Sacc. was reported as 2.263, the TOS value as 33.022 and the OSI value as 1.459 (Sevindik et al. 2018c). The TAS value of *Omphalotus olearius* (DC.) Singer was 2.827, the TOS value was 14.210 and the OSI value was 0.503 (Sevindik et al. 2017). *Auricularia auricula-judae* (Bull.) Quél. and *Trametes versicolor* (L.) Lloyd mushrooms were reported to have the TAS values of 1.010 and 0.820 mmol/L, TOS values of 23.910 and 17.760 µmol/L, and OSI values of 2.367 and 2.166, respectively (Akgül et al. 2017).

It was determined that the TAS value of *P. involutus* mushroom was lower than that of *O. olearius, H. leucomelaena, C. cylindracea* and *P. limonella* mushrooms, and higher than that of *A. auricula* and *T. versicolor* mushrooms in the present study. It was observed that the TOS value of *P. involutus* mushroom was lower than that of *H. leucomelaena, O. olearius, C. cylindracea*, *P. limonella, A. auricula* and *T. versicolor* mushrooms. OSI value was higher than that of *O. olearius* and *C. cylindracea* mushrooms, and lower than that of *H. leucomelaena, P. limonella, A. auricula* and *T. versicolor* mushrooms.

It was considered that the diversity among the mushrooms was due to the differences between the areas where the mushroom grew and the mushroom species. It was deter-

mined that the *P. involutus* mushroom possessed a higher antioxidant potential when compared to the *A. auricula* and *T. versicolor* mushrooms reported in the literature. Furthermore, the fact that it has a lower oxidative stress status when compared to the above-mentioned mushrooms suggested that *P. involutus* inhibited the oxidant compounds. *P. involutus* possessed a lower antioxidant potential when compared to *O. olearius, H. leucomelaena, C. cylindracea* and *P. limonella* mushrooms, and thus it was found that oxidant compounds were less inhibited. As a result, it was determined that *P. involutus* expressed antioxidant potential and secondary metabolites that affect this antioxidant potential were identified and it could be used as a natural antioxidant source.

4. Conclusion

The antioxidant potential of *P. involutus* mushrooms collected from Burdur province and determined with TAS, TOS and OSI values was reported for the first time in the present study. The conducted analyses demonstrated that *P. involutus* mushroom exhibited antioxidant potential and with the determination of the antioxidant compounds via future secondary metabolite analyses the mushroom could be consumed as a natural antioxidant source.

Conflicts of Interest: No conflict of interest was declared by the authors.

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