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Determination of Oxidative Stress Status of *Ompholatus olearius* Gathered From Adana and Antalya Provinces in Turkey

Mustafa Sevındık[1*], Hasan Akgul[2], Celal Bal[3]

ABSTRACT

The objective of the present study is to determine and compare total antioxidant status (TAS), total oxidant status (TOS), oxidative stress index (OSI) values and heavy metal content of *Omphalotus olearius* samples, known as a poisonous mushroom and gathered from Adana (Karaisalı) and Antalya (Konyaaltı) provinces. TAS, TOS and OSI values were determined using Rel Assay kits. Heavy metal content was measured with atomic absorption spectrophotometer. The results of this study demonstrated that the sample gathered in Antalya had a higher oxidative stress index and generally higher heavy metal content.

Anahtar Kelimeler: *Omphalotus olearius*, Oxidative stress, Antioxidant, Oxidant, Heavy metals

Adana ve Antalya'dan Toplanan *Ompholatus olearius*'un Oksidatif Stres Durumunun Belirlenmesi

ÖZ

Bu çalışmada, agulu mantar olarak bilinen ve zehirli olan *Omphalotus olearius* (DC.) Singer mantarının Adana ve Antalya illerinden toplanan örneklerinin Toplam antioksidan seviyesi (TAS), toplam oksidan seviyesi (TOS), oksidatif stres indeksi (OSİ) değerleri ile ağır metal içeriklerinin belirlenmesi ve kıyaslanması amaçlanmıştır. TAS, TOS ve OSİ değerleri Rel Assay kitleri kullanılarak belirlenmiştir. Ağır metal içerikleri atomik absorpsiyon spektrofotometresi kullanılarak ölçülmüştür. Yapılan çalışmalar sonucunda; Antalya'dan toplanan örneğin oksidatif stres indeksinin ve genel olarak ağır metal içeriklerinin daha yüksek olduğu belirlenmiştir.

Keywords: *Omphalotus olearius*, Oksidatif Stres, Antioksidan, Oksidan, Ağır Metal

1. INTRODUCTION

Cosmopolitan mushrooms play a role in organic matter catabolism which is required for the continuation of vitality [1]. Thus, they contain higher heavy metal content when compared to cultivated plants, fruits and vegetables [2]. Although human need trace amounts of heavy metals such as Fe, Co, Cu, Mn, Cr and Zn for metabolic reactions, but when these heavy metals accumulate in the body and when they consume nutrients with high heavy metal content, this would result in a toxic effect on the organism, slowing down metabolic reactions [3].

As a result of oxidative stress that occurs due to factors such as environmental pollution, several health problems such as cardiologic and neurologic diseases and cancer could be induced [4]. All living organisms have defense mechanisms against oxidative stress and antioxidant enzymes that protect their biological systems prevent the cells from damage [5]. However, when the oxidative stress level increases, consumption of antioxidant-rich nutrients is necessary as supplements [6]. Thus, it is important for human health to determine heavy metal, total antioxidant and oxidative stress levels, total antioxidant, total oxidant and oxidative stress levels of mushrooms consumed as nutrients and used for medical purposes. The objective of the present study is to determine and compare total antioxidant status (TAS), total oxidant status (TOS), oxidative stress index (OSI) values and heavy metal content of *Omphalotus olearius* (DC.) Singer, samples gathered from Adana and Antalya provinces.

2. MATERIAL AND METHOD

Mushroom samples were collected in Adana-Karaisalı and Antalya-Konyaaltı regions. Collected mushrooms were l initially dried in an incubator at 40 °C, then they were pulverized with a mechanical grinder. Pulverized mushrooms were separated into 30 g cartridges and extracted for approximately 6 hours at 50 ^{0}C using soxhlet extractor (BUCHI Extraction System Model B-811) with ethanol. Obtained ethanol extracts were condensed in a rotary (BUCHI Rotavapor Model R-144) at 40 ^{0}C and under pressure so that the assays could be conducted at +4 ^{0}C.

Figure 1. *Omphalotus olearius* (DC.) Singer 1948.

2.1. Determination of TAS, TOS and OSI Values

Mushroom TAS and TOS values were measured with Rel Assay brand commercial kits (Rel Assay Kit Diagnostics, Turkey). Trolox was used as a calibrator for TAS tests and the results were expressed in mmol Trolox equiv./L [7]. Hydrogen peroxide was used as a calibrator for TOS tests and the results were expressed in mmol H_2O_2 equiv./L [8]. OSI values were calculated with the formula given below (1) [8].

$$OSI = \frac{\text{TOS, } \mu\text{mol } H_2O_2 \text{ equiv./L}}{\text{TAS, mmol Trolox equiv./L X 10}} \quad (1)$$

2.2. Determination of Heavy Metal Contents

Mushrooms were dried at 40 °C in an incubator and ground in a mortar. 1 g samples were placed in three 50 mL glass Erlenmeyer flasks. 10 mL concentrated HNO_3 was added to the Erlenmeyer flasks and they were left to rest at ambient temperature for 24 hours. These samples were heated on a hot-plate under sediment is formed. Later on, 10 mL concentrated HCl was added in Erlenmeyer flasks and firing process was repeated. After this process, 20 mL diluted HCl was added to the samples and they were filtered [9]. Mushroom sample element content was identified using Perkin Elmer (AAnalist 400) equipment.

3. RESULTS

3.1. TAS, TOS and OSI Results

TAS (mmol/L), TOS (μmol/L) and OSI values for mushroom samples collected from Adana and Antalya provinces are presented in table 1.

Table 1 TAS, TOS and OSI values

Locality	TAS (mmol/L)	TOS (μmol/L)	OSI (TOS/(TAS*10))
Adana	2.836	8.262	0.291
Antalya	2.827	14.210	0.503

3.2. Heavy Metal Contents

As a result of heavy metal analyses, the heavy metal content of mushroom samples were determined as mg.kg^{-1}. Mushroom sample heavy metal content is presented in table 2 as Mean ± SD. Furthermore, mushroom heavy metal concentrations are displayed graphically in Figures 2, 3, 4, 5, and 6.

Table 2. Heavy metal levels of fungal samples

	Adana	Antalya
Fe (mg.kg^{-1})	85.88±13.84	233.10±12.52
Zn (mg.kg^{-1})	46.59±7.09	43.73±0.04
Cu (mg.kg^{-1})	7.72±0.92	8.54±1.69
Pb (mg.kg^{-1})	7.00±0.42	6.49±0.54
Ni (mg.kg^{-1})	0.00	1.37±0.28

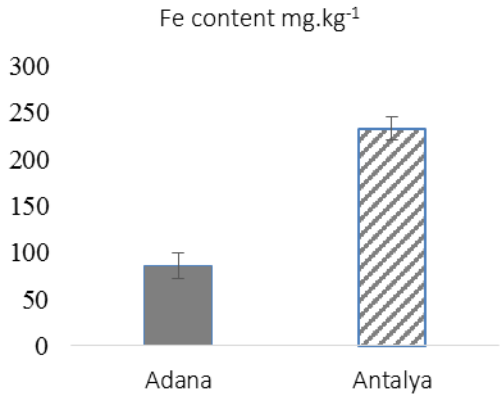

Figure 2. Mushroom sample Fe concentrations

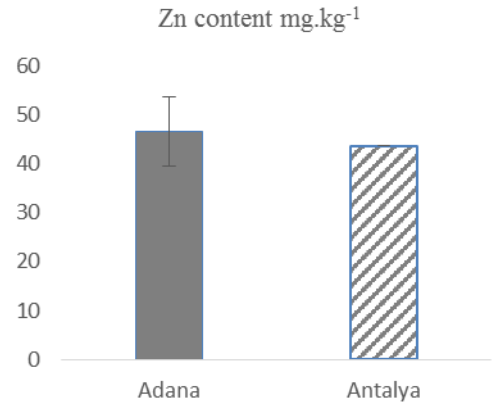

Figure 3. Mushroom sample Zn concentrations

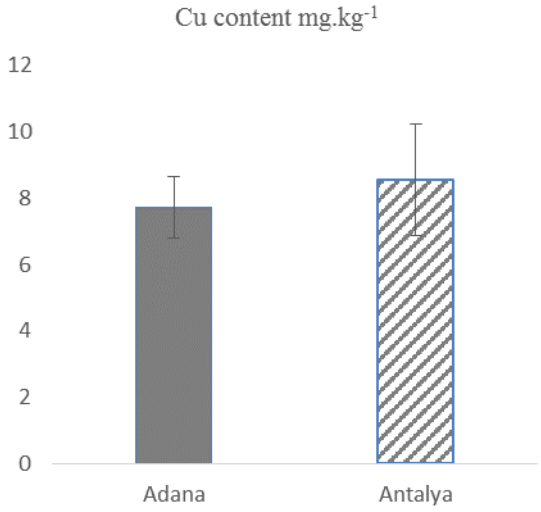

Figure 4. Mushroom sample Cu concentrations

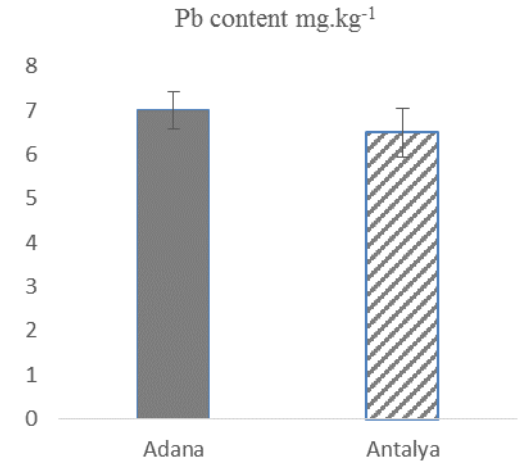

Figure 5. Mushroom sample Pb concentrations

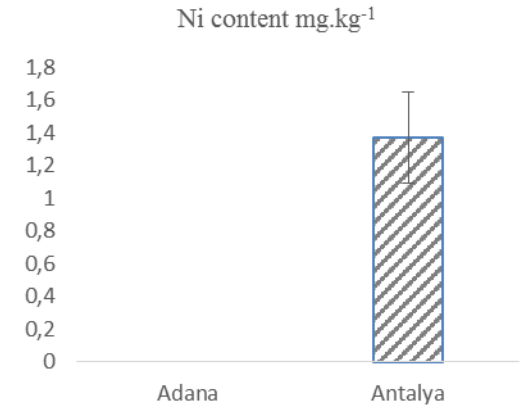

Figure 6. Mushroom sample Ni concentrations

4. CONCLUSION AND DISCUSSION

It was determined that TAS values of *O. olearius* gathered from Adana and Antalya provinces were similar. However, TOS values of *O. olearius* gathered from Antalya province were higher than that of the sample gathered from Adana province. Thus, OSI values were adequate for the samples gathered in Adana. Furthermore, it was considered that albeit poisonous, *O. olearius* was an effective antioxidant source due to its high total antioxidant levels.

In a study conducted on *Macrolepiota procera* (Scop.) Singer gathered from Antalya (Akseki) and Balıkesir (Kazdağı National Reserve) provinces, TAS values were determined as 2.823 (mmol/L) and 2.805 (mmol/L), TOS values were determined as 10.349 and 6.596 (µmol/L), and OSI values were determined as 0.367 and 0.235, respectively [4]. When compared to the findings of the present study, it was observed that Antalya Konyaaltı OSI values were higher compared to Akseki township. This could have occurred due to higher exposure of Konyaaltı to anthropogenic effects. Moreover, it was identified that Adana province had lower oxidative stress index compared to Antalya province and higher oxidative stress index compared to Balıkesir province.

Mushrooms could be used as pollution indicators in nature with respect to the elements they absorb [9]. It was determined that samples gathered from Antalya province had higher heavy metal levels when compared to those gathered in Adana province. Based on the literature review, the lowest and highest element content for mushrooms were determined as 14.6 - 835 for Fe, 600 - 2500 for Mg, 29.8 - 158 for Zn, 71 - 95 for Cu, 2.86 - 6.88 for Pb, and 1.18 - 5.14 $mg.kg^{-1}$ for Ni [10]. Compared to these ranges specified in the literature, it was observed that Cu element was lower in the samples collected from both provinces. However, Pb content was higher in the samples collected from Adana province. Other elements were within the ranges specified in the literature. As a result, it was determined that heavy metal content of the mushroom samples were parallel to their oxidative stress levels. It could be argued that mushroom sample gathered in Adana province was more healthy and Adana province was a better environment for mushroom cultivation based on the oxidative stress index. Furthermore, it would be important to identify the oxidative stress indices in other regions of Adana and Antalya provinces in future studies to determine the oxidative stress levels of Adana and Antalya provinces.

REFERENCES

[1] I. Akata, B. Ergönül ve F. Kalyoncu, «Chemical Compositions and Antioxidant Activities of 16 Wild Edible Mushroom Species Grown in Anatolia,» *International Journal of Pharmacology,* cilt 8, no. 2, pp. 134-138, 2012.

[2] B. Liu, Q. Huang , H. Cai, X. Guo, T. Wang ve M. Gui, «Study of heavy metal concentrations in wild edible mushrooms in Yunnan Province,,» *Food Chemistry,* cilt 188, no. 2015, pp. 294-300, 2015.

[3] C. Sarıkürkçü, M. Çopur, D. Yıldız ve I. Akata, «Metal concentration of wild edible mushrooms in Soğuksu National Park in Turkey,» *Food Chemistry,* cilt 128, no. 2011, pp. 731-734, 2011.

[4] H. Akgül, M. Sevindik, I. Akata, D. Altuntaş, C. Bal ve M. Doğan, «Macrolepiota procera (Scop.) Singer. Mantarının Ağır Metal İçeriklerinin ve Oksidatif Stres Durumunun Belirlenmesi,» *Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Dergisi,* no. DOI: 10.19113/sdufbed.56964, 2016.

[5] L. Ren, Y. Hemara, C. O. Perera, G. Lewis, W. G. Krissansen ve K. P. Buchanan, «Antibacterial and antioxidant activities of aqueous extracts of eight edible mushrooms,» *Bioactive Carbohydrates and Dietary Fibre,* cilt 3, no. 2014, pp. 41-51, 2014.

[6] S. Öğüt ve E. Atay, «Yaşlılık ve oksidatif stres,» *S.D.Ü. Tıp Fak. Dergisi,* cilt 19, no. 2, pp. 68-74, 2012.

[7] O. Erel, «A novel automated direct measurement method for total antioxidant capacity using a new generation, more stable ABTS radicalcation,» *Clin Biochem.,* cilt 2004, no. 37, pp. 277-85, 2004.

[8] O. Erel, «A new automated colorimetric method for measuring total oxidant status,» *Clin Biochem.,* cilt 2005, no. 38, pp. 1103-1111, 2005.

[9] M. Sevindik, H. Akgül, S. Günal ve M. Doğan, «Pleurotus ostreatus'un Doğal ve Kültür Formlarının Antimikrobiyal Aktiviteleri ve Mineral Madde İçeriklerinin Belirlenmesi.,» *Kastamonu Uni., Orman Fakültesi Dergisi,* cilt 16, no. 1, pp. 153-156, 2016.

[10] S. E. Mallikarjuna, A. Ranjini, D. J. Haware, M. R. Vijayalakshmi, M. N. Shashirekha ve S. Rajarathnam, «Mineral Composition of Four Edible Mushrooms.,» *Journal of Chemistry,* cilt 2013, no. 1, pp. 1-5, 2013.