Antioxidant Activity and Element Content of *Suillus collinitus*

Celal Bal1,a,*

1Oguzeli Vocational School, Gaziantep University, Gaziantep, Turkey
*aCorresponding author*

**A R T I C L E  I N F O**

**A B S T R A C T**

Mushrooms used as food have medicinal importance due to their antioxidant compounds. In this context, it is very important to determine the biological potential of fungi and to reveal these medicinal properties. In this study, it was aimed to determine the element contents, total antioxidant status, total oxidant status, oxidative stress index of *Suillus collinitus* (Fr.) Kuntze mushroom. In this context, the mushroom samples were extracted with ethanol in the Soxhlet extractor. Element contents were determined using atomic absorption spectrometry. Total antioxidant (TAS) and total oxidant (TOS) levels and oxidative stress index (OSI) were determined using Rel Assay commercial kits. As a result of the study, it was determined that the TAS value of *S. collinitus* was 2.467 ± 0.145 mmol/L, TOS value was 17.845 ± 0.273 µmol/L and OSI value was 0.677 ± 0.030. In addition, the Fe content (350.72 ± 10.23), Cu content (68.11 ± 2.51), Pb content (11.58 ± 2.43), Zn content (10.46 ± 1.28) and Ni content (1.47 ± 0.21 mg.kg⁻¹) of *S. collinitus* measured. As a result, *S. collinitus* mushroom is thought to be a natural source of antioxidants. It has also been observed that the element contents are at normal levels.

**Keywords:** *Suillus collinitus* Antioxidant Oxidative stress Element content Medicinal mushroom

Introduction

A better understanding of the high nutritional value and medicinal importance of mushrooms in recent years has led to an increased interest in mushrooms. In addition to nutritional values, it has been determined that the active ingredients in its content have a therapeutic effect (Arpaz et al., 2017). Many studies have shown that mushrooms have different biological activities. In studies on mushrooms, it has been reported to have many activities such as antioxidant, antitumor, antimicrobial, anti- aromatase activity, anti-inflammatory activity, antiproliferative activity and immunomodulatory activity (Akgul et al., 2017; Bal et al., 2017; Kikuchi et al., 2017; Sriramulu and Sumathi, 2017; Wang et al., 2018; Sevindik 2018a; Gürgen et al., 2020; Mushtaq et al., 2020). Turkey has a high diversity in terms of biodiversity. This diversity is increasing due to the different phytogeographical regions (Akata et al., 2018). In this study, *Suillus collinitus* mushroom collected from Gaziantep/Oguzeli (Turkey) was used as a material. *Suillus collinitus*, one of the edible mushrooms, is porous and mostly spreads in pine forests. Cap height is 8-11 cm. Its surface is slippery. Their color is light brown. It has a sour smell and a different taste. It spreads in clusters (Bonfante, 1998).

Antioxidant activity studies previously performed on *Suillus* species are shown in table 1.

In this study, TAS, TOS, OSI and some element contents of *S. collinitus* mushroom were determined.

Materials and Methods

Study material *S. collinitus* samples were collected from Oguzeli/Gaziantep (Turkey). The samples were dried in an oven at 40°C 30 g of the dry samples was weighed and extracted in the soxhlet apparatus at 50°C for about 6 hours (BUCHI Extraction System Model B-811). The dry extract was then concentrated in a rotary evaporator (BUCHI Rotavapor Model R-144).

**Determination of Element Content**

Fe, Zn, Cu, Pb and Ni contents of *S. collinitus* were determined by using atomic absorption spectrophotometer device (Agilent 240FS AA). Before reading, the samples were dried at 80°C to constant weight. 0.5 g of the dry...
samples were mineralized using a microwave solubilizer (Milestone Ethos Easy) in a mixture of 9 mL HNO3 + 1 mL H2O2 (Sevindik and Akata, 2019).

**TAS, TOS and OSI Tests**

Total antioxidant status and the total oxidant status of study material Rel Assay brand commercial kits (Rel Assay Kit Diagnostics, Turkey) was used. The calibrator Trolox was used in antioxidant kits. Results are shown in mmol Trolox equiv./L. Calibrator hydrogen peroxide was used in oxidant kits. Results are shown as mmol H2O2 equiv./L (Erel, 2004, 2005). The oxidative stress index was calculated with the formula TOS / (TASx10) (Erel, 2004, 2005). The oxidative stress index shows how much the fungus suppresses oxidative stress. In cases where the antioxidant defense system is insufficient, supplementary antioxidant sources are used (Mohammed, 2020). In this study, TAS, TOS and OSI values of *Suillus collinitus* mushroom were determined. The findings obtained are shown in Table 3.

**Results and Discussion**

**Element Contents**

Fungi play a role in breaking down organic cover in the ecosystem. During the breakdown of the organic cover, they accumulate different levels of elements in their bodies depending on the substrate content they use (Baba et al., 2012; Baba et al., 2020). In our study, the Fe, Zn, Cu, Pb and Ni contents of *Suillus* species were determined. The findings obtained are shown in Table 2.

In previous studies, the levels of elements detected in wild mushrooms have been reported in the literature. These values were reported as 14.6-835.0 for Fe, 29.8-158.0 for Zn, 71.0-95.0 for Cu, 2.86-6.88 for Pb and 1.18-5.14 for Ni in mg/kg (Vetter, 1990; Sevindik et al., 2017; Krupodorova and Sevindik, 2020). Compared to these values, it was determined that the Zn, Cu and Ni contents of *S. collinitus* were lower than the literature ranges, the Pb content was higher than the literature ranges, and the Fe levels were within the literature ranges. In this context, it is seen that the element levels of *S. collinitus* are at normal levels.

**TAS, TOS and OSI Values**

Living organisms produce reactive oxygen species (ROS) as a result of metabolic activities. While these ROS compounds have a beneficial effect in low amounts, they cause oxidative stress when they reach high levels (Kattoor et al., 2017; Mohammed et al., 2018). As a result of oxidative stress in living things, different diseases such as cardioiological disorders, Alzheimer, Parkinson's and cancer occur (Salim, 2017; Mohammed et al., 2019). The antioxidant defense system plays a role in reducing oxidative stress. In cases where the antioxidant defense system is insufficient, supplementary antioxidant sources are used (Mohammed, 2020). In this study, TAS, TOS and OSI values of *Suillus collinitus* mushroom were determined. The findings obtained are shown in table 3.

**Table 1. Antioxidant activities of Suillus species**

| Suillus species            | References                     |
|----------------------------|--------------------------------|
| *Suillus aeruginascens*    | Macákóvá et al., 2009;         |
| *Suillus bellini*          | Ribeiro et al., 2006; Kalogeropoulos et al., 2013; |
| *Suillus bovinus*          | Robaszkiewicz et al., 2010;    |
| *Suillus collinitus*       | Akata et al., 2012; Heleno et al., 2010; |
| *Suillus granulatus*       | Macákóvá et al., 2009; Ribeiro et al., 2006 |
| *Suillus granulatus*       | Ribeiro et al., 2006; Reis et al., 2014; Tel et al., 2014; Zhou et al., 2016; Chen et al., 2018; |
| *Suillus grevillei*        | Mushtaq et al., 2020; Macákóvá et al., 2009 |
| *Suillus lakei*            | Barranco et al., 2010;         |
| *Suillus latexus*          | Ribeiro et al., 2006; Macákóvá et al., 2009; Barranco et al., 2010; Jaworska et al., 2014; Macákóvá et al., 2009; Keles et al., 2011; Heleno et al., 2010; |
| *Suillus mediterraneensis* | Macákóvá et al., 2009;         |
| *Suillus placidus*         | Macákóvá et al., 2009;         |
| *Suillus variegates*       | Macákóvá et al., 2009; Robaszkiewicz et al., 2010 |
Table 2. Element Levels of *S. collinitus*

| Elements | Fe       | Zn       | Cu       | Pb       | Ni      |
|----------|----------|----------|----------|----------|---------|
| *S. collinitus* | 350.72 ± 10.23 | 10.46 ± 1.28 | 68.11 ± 2.51 | 11.58 ± 2.43 | 1.47 ± 0.21 |

Values are presented as mean ± S.D, n=3 (Experiments were made as 3 parallel)

Table 3. TAS, TOS ve OSI Values

| Material | TAS    | TOS    | OSI    |
|----------|--------|--------|--------|
| *S. collinitus* | 2.467 ± 0.145 | 17.845 ± 0.273 | 0.677 ± 0.030 |

Values are presented as mean ± S.D.; n=6 (Experiments were made as 5 parallel)

Conclusion

In this study, the antioxidant activity of *S. collinitus* and the levels of some elements were determined. As a result of the studies, it has been determined that the mushroom has antioxidant potential. Element levels were found to be at normal levels according to the stated literature values.

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