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**PHYSIOLOGICAL, ETNOBOTANICAL, BIOLOGICAL and MEDICAL
PROPERTIES of KEME (*Terfezia claveryi* Chatin) MUSHROOM**

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ABSTRACT

The need for alternative food sources has become increasingly with the increasing population. Mushroom, providing suitable conditions easy in case, it is a product that can be grown and has high nutritional value. In this review, importance of Keme mushrooms investigated in terms of physiological, ethnobotanical, biological and medical properties according to previous studies. In this review, information to the nutritional value, physiological properties, ethnobotanical properties, biological properties, medical properties and cultivation of mushrooms.

Introduction

Keme mushroom is a type of mushroom known as *Terfezia claveryi* Chatin in Latin. And *T. claveryi* is called as keme, kumi, tombalak in Turkish (Şahin, Kaşık, Alkan, & Özcan, 2020).

Keme mushroom is spherical in shape with a flattened upper part and it looks like a potato tuber. It has a reddish and pale brown color in

generally (Gücin & Dülger, 1997). Especially It should be noted that it is easy to use, when it peels off. The classification of keme is as follows (Anonymous, 2021a; İnci, 2017).

Kingdom : Fungi
Classis : Pezizomycetes
Order : Pezizales
Family : Pezizaceae
Genus : Terfezia

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Figure 1. Appearance of *Terfezia claveryi* (Şahin, Kaşık, Alkan, & Özcan, 2020).

Ethnobotanic Structure of Keme Mushroom

In the concept of ethnobotany, ethnos means the study of the local people, and botany means the branch of science in which plants are research. The word ethnobotany, on the other hand, includes the "people and plant" relationship that gains meaning with the combination of these two concepts (Şahin Fidan & Akan, 2019; Yıldırım, 2004).

The importance of ethnobotany has been influenced by the use of plants to treat diseases when ancient times. In ethnobotanical stands out treating disease. Mushroom has got a lot of property. It has been used as medicine and food in Chinese, Roman and Greek Civilizations and that many bioactive components they contain have antagonistic effects (İnci, 2017; Iwalokun, Usen, Otunba, & Olukoya, 2007; Paulik, Svrcek, Huska, Mojziso, Durove, & Benisek, 1992).

Growing Conditions of Keme Mushroom

Species of *Terfezia* grow naturally in arid and semi-arid areas where the Mediterranean climate. In Turkey, they grow naturally in Southeastern Anatolia region. They grow in the spring. Especially from January to April

(Díez, Manjón, & Martín, 2002; Şahin, Kaşık, Alkan, & Özcan, 2020).



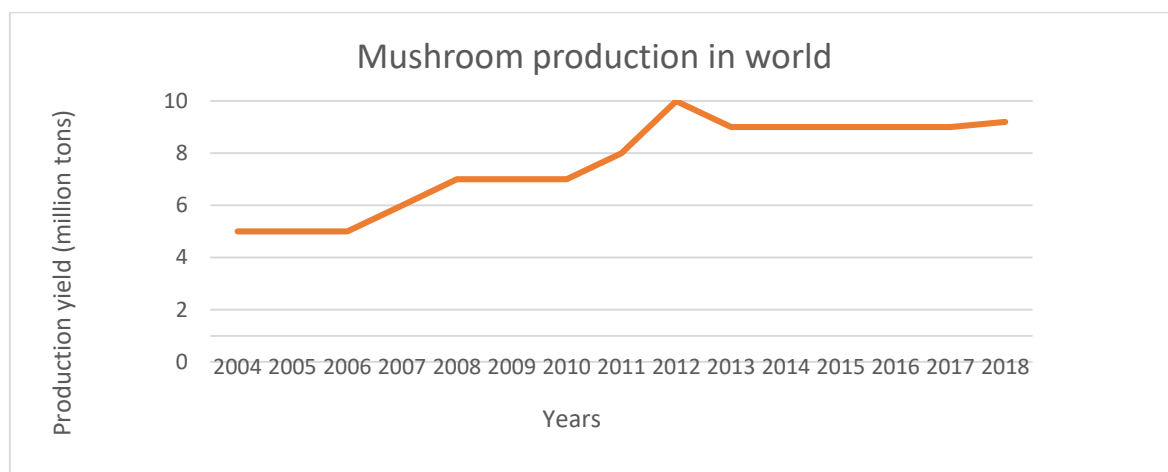
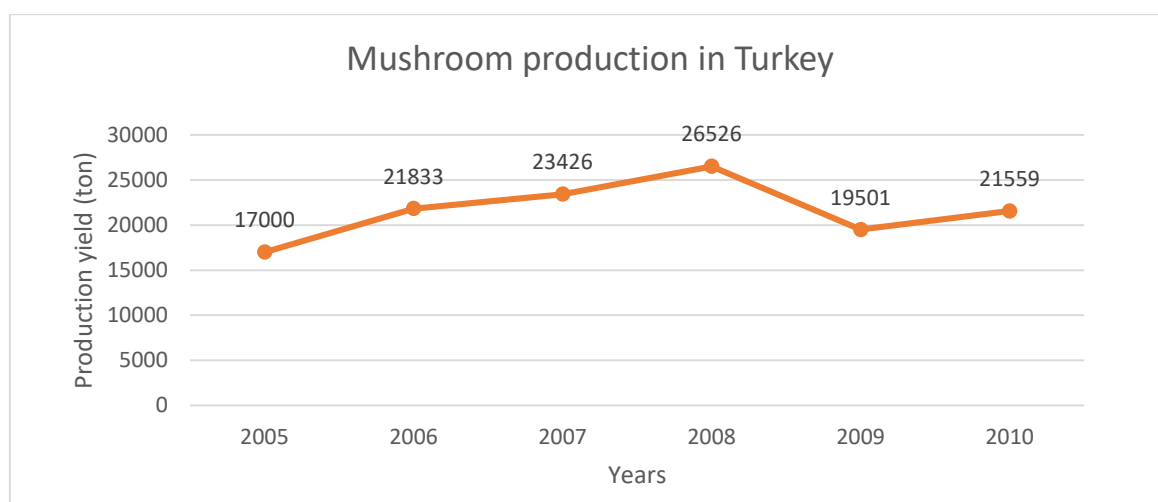
Figure 2. The growing area of *Terfezia claveryi* in Turkey (İnci, 2017).

This mushroom is 30 cm below the soil and can crack the soil after it matures, it can be easily detected (Gutiérrez, Morte, & Honrubia, 2003). Experienced harvesters can locate truffles through cracks in the soil just above the truffle.

In our country keme grow naturally and they are sold bazaars and markets at seasonal time. They has pleasant taste of our meal and are high in economic value. They are rich food source especially protein value (Gücin & Dülger, 1997; Morte, Zamora, Gutiérrez, & Honrubia, 2009).

Mushroom production is very high in the World due to its rich nutritional value, and its distribution over the years is as in the table.

There are a lot of mushroom varieties with rich nutritional values in Turkey. One of them is keme mushroom. The table shows the production amount in Turkey. China is the highest mushroom producer in the world. On the other hand In Turkey, the amount of production increases over time (Eren & Pekşen, 2016)

Table 1. Mushroom production in world by years (Kumla, Suwannarach, Sujarit, Penkhrue, Kakumyan, Jatuwong, et al., 2020).**Table 2.** Mushroom production in Turkey by years (Aydın & Yılmaz, 2012).

Nutritional Value and Physiological Properties of Keme Mushroom

The nutritional value of keme mushroom is 13% protein, %2 oil, %5 raw fiber %5 ash, 129 mg/100 g Ca, 104 mg/100 g Mg, 756 mg/100 g P, 199 mg/100 g Na, 1730 mg/100 g K, 10.68 mg/100 g Fe, 0.48 mg/100 g Mn, 1.69 mg/100 g Cu, 5.10 mg/100 g Zn (Sawaya, Al-Shalhat, Al-Sogair, & Al-Mohammad, 1985).

The triterpene Squalene was detected in chemical analyzes of the hexane extract of *Terfezia claveryi Chatin*. It has been reported

that squalene has a chemically preventive and anti-tumor effect on colon cancer cells thanks to its potential effect, and also contributes either directly or indirectly to the treatment of cancer (Dahham, Al-Rawi, Ibrahim, Majid, & Majid, 2018).

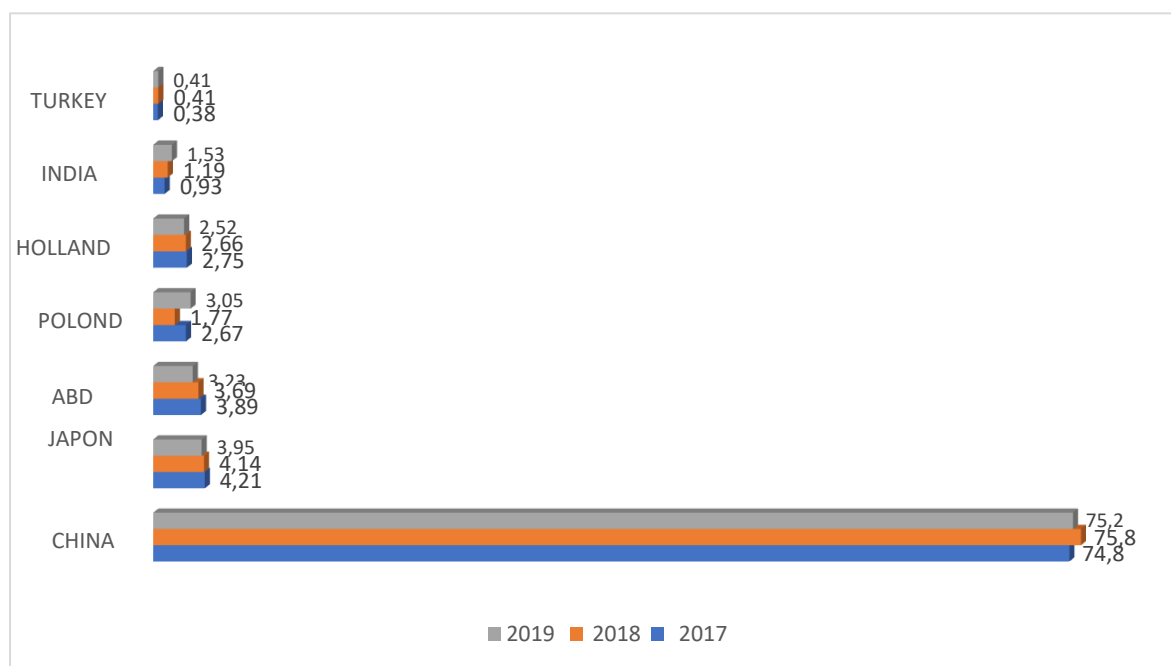
It has been reported that there is a positive correlation between total phenolic contents and antioxidant capacities of *Terfezia claveryi Chatin* (Özyürek, Bener, Güçlü, & Apak, 2014).

The therapeutic effect of *Terfezia claveryi Chatin* on corneal ulcers of rabbits in vivo

were investigated in a study. It has been determined that *Terfezia clavaryi* Chatin reduces corneal ulceration and has an antimicrobial effect compared to a synthetic antibiotic vigamox (Aldebasi, Aly, Qureshi, & Khadri, 2013).

In Iraq, Saudi Arabia and Eastern Jordan, *Terfezia clavaryi* Chatin aqueous extract is used as a medicine to cure eye diseases instead of some antibiotic drugs (Janakat & Nassar, 2010).

Table 3. Mushroom production in Turkey and other country (Aydın & Yılmaz, 2012).



Other features of keme mushrooms are as follows (Anonymous, 2021b, 2021c);

- ✓ High amounts of vitamins A, C,
- ✓ Antioxidant substance such as β -carotene
- ✓ Many phenolic compounds
- ✓ It is good for high cholesterol because it contains unsaturated fatty acids.
- ✓ It also contains rich of protein and protects cholesterol.
- ✓ It is beneficial for eye diseases.
- ✓ Along with its nutritious feature, it offers a healthy food source as well as meat.
- ✓ One of the most important known benefits of keme mushroom is that it creates an aphrodisiac effect.
- ✓ It is an important source of fiber and provides the opportunity to diet effectively.
- ✓ It is very effective in strengthening the spinal cord.



Figure 3. Growing area of keme mushroom (Anonymous, 2016).

Literature About of Keme Mushroom

The previous studies could be arranged keme mushroom as follows;

Keme mushroom is beneficial for the eyes diseases, so a lot of studies have been done. For instance, Ionaşcu et al. (2018), investigated to a purified extract from brown truffles of the species *T. claveryi Chatin* - alternative therapy in dog and cat glaucoma. As a result, The study show that concentrated extract (Truffle eye drops) reduces the intraocular pressure (IOP) in glaucomatous eyes comparatively to classical therapy (Ionaşcu, Moscovici, Casarica, & Daas, 2018). And other study about beneficial of eyes disease investigated to the antimicrobial effects of *T. claveryi* and *T. boudieri* Chatin against bacteria isolates associated with eye infections and their molecular mechanism. In conclusion, extracts of both *Terfezia* species have demonstrated the potential to possess antibacterial activity, which can be further exploited for clinical use (Badger-Emeka, Emeka, Aldossari, & Khalil, 2020).

Keme mushroom's very rich amount of protein. It has been the focus of studies due to it is beneficial against to various disease. For

example Ammarellou (2007) aimed to analyze Protein extracts from a species of desert truffle (*T. claveryi Chatin*) using polyacrylamid gel electrophoresis (PAGE) method. In conclusion, the method find 13 special proteins of desert truffle. The study is the first on electrophoretic protein banding in Iranian *Terfezia* (Ammarellou, 2007). And other study is about free amino acids, phenolic and sugar compounds, mineral and heavy metal contents of *T. claveryi* from Turkey. As a result, *T. claveryi* Show that has a very increase nutritional value and as food additives for extension of products' shelf life food and dietary supplement industries (Kivrak, 2015).

Keme mushroom has a antibacterial property. In many study is showed that the property is important variety diseases. For instance, Janakat et al., (2005) investigated to the antibacterial activities of aqueous and methanolic extracts, as well as, partially purified proteins extracted from *T. claveryi* aqueous, against *Pseudomonas aeruginosa*. In conclusion, Aqueous extract of the mushroom. *T. claveryi* contains a potent antimicrobial agent that is protein in nature and may be used in the treatment of eye infections caused by *P. aeruginosa* (Janakat & Nassar, 2010). Other

study investigated the Characterization of bio-peptides purified from *T. claveryi* hydrolysate and their antibacterial effect on raw milk. The aimed to examining the antibacterial and antioxidant properties of the hydrolysate of *T. claveryi* protein by a mixture of trypsin and chymotrypsin in-vitro, identifying the potential peptides responsible for the observed effects (Farzaneh, Ehsani, Khanahmadi, & Sharifan, 2019). And other study investigated to Antioxidant, anticancer, apoptosis properties and chemical composition of black truffle *T. claveryi*. Conclusion, the antioxidant, chemical composition, anticancer, and anti-angiogenesis properties of the *T. claveryi* truffle were investigated. Solvent extractions of the *T. claveryi* were evaluated for antioxidant activities using (DPPH, FRAP and ABTS methods(Dahham, Al-Rawi, Ibrahim, Majid, & Majid, 2018).

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Conclusion

Keme mushroom is a very important nutrition for human healthy as food additives for dietary supplement industries. People need to consume this food more. It may be a functional product in future. It could be possible to increase the consumption of Keme mushroom with scientific research.

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