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Enginar Kabuğu ve Greyfurt Ekstratının Antifungal, Antimikrobiyal ve Antioksidan Etkileri Üzerine Bir İnceleme

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A Review On The Antifungal, Antimicrobial And Antioxidant Effects Of Artichoke Leaf And Grapefruit

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Abstract

Natural plant and fruit extracts have become a popular topic nowadays. Plants, fruits, plant extracts and plant wastes have been used for years in the natural preservation of food. Many studies have been conducted on the recycling of waste parts of extracts and their use in foods as natural preservatives. This article reviews the antifungal, antimicrobial and antioxidant properties of artichoke peel and grapefruit extracts.

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Öz

Doğal bitki ve meyve ekstraktları günümüzde popüler bir konu haline gelmiştir. Bitkiler, meyveler, bitki özleri ve bitki artıkları gıdaların doğal yollarla muhafaza edilmesinde yıllardır kullanılmaktadır. Ekstraktların atık kısımlarının geri dönüştürülmesi ve gıdalarda doğal koruyucu olarak kullanılması üzerine birçok çalışma yapılmıştır. Bu makalede enginar kabuğu ve greyfurt ekstraktlarının antifungal, antimikrobiyal ve antioksidan özellikleri derlenmiştir.

1. INTRODUCTION (GİRİŞ)

Plants are highly valued in many industries for their fragrance, medicinal or aromatic properties [1, 2, 3]. It has been reported that aromatic plants with antimicrobial and antioxidant effects are used in the treatment of many diseases from the common cold to cancer [4, 5]

Today, the interest in natural additives is increasing due to the harm of some chemical additives to human health [6]. With the increase in demand for products with minimal processing and natural additives, studies on active ingredients in spices, extracts obtained from spices and essential oils have also gained momentum. It has been determined that the addition of these components to foods extends the shelf life of foods by preventing/delaying microbial spoilage, antioxidant bacteriostatic/fungistatic effect and preventing oxidative rancidity, as well as the aroma created in the food [7, 8, 9, 10].

Phytochemicals synthesized in the secondary metabolism of many plants have antimicrobial effects against microorganisms and are used as antimicrobial agents in various products due to these properties [11, 12, 13]. In in vitro studies, it has been determined that plants have many secondary metabolites such as alkaloids, tannins, flavonoids and phenolic compounds with antimicrobial properties [13, 14, 15].

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It has been stated that phenolic compounds such as gallic acid and tannin in plants inhibit the enzymes that synthesize ergosterol via binding to the membrane or have antifungal effects that cause cell death by forming pores in the cell membrane [16]. While bioactive compounds such as carvacol, eugenol, and thymol, which act as antifungals, interact with certain enzymes and cause cell disruption [17] compounds such as tomatidine, diallyl sulfides and benzyl isothiocyanate also exert antifungal effects [18,19, 20].

Plant-based ingredients; are the origins of natural substances that prevent oxidation in foods. They can be produced from chemical reactions (e.g., products of the maillard reaction) or extracted from non-food ingredients. The most active antioxidants; polyphenols and phenolic compounds [21] Spices, are very rich in terms of substances such as phenolic acid, flavonoid and aromatic compounds [22]. The presence of free-OH groups in the structures of phenolic compounds that act as antioxidants cause antioxidant properties. It also reduces the growth medium's redox potential by binding free radicals. This decrease in redox potential further limits the undesirable microorganisms' growth. It has also been reported to limit the reactive oxygen species' formation [23].

The antioxidant effects of pure components of essential oils and different plant extracts can be measured by various in vitro assays [24, 25]. Especially natural antioxidants in plants have started to gain importance in scientific studies. Studies showed that the risk of cardiovascular disease and cancer is lower as a result of frequent consumption of natural antioxidants [26].

It is thought that the antifungal, antimicrobial, and antioxidant properties of artichoke leaf and grapefruit extracts used in this review can be used as a natural additive by investigating. In addition, the possibilities of using the waste plant parts of the plant extracts used are also suggested.

2. ANTIMICROBIAL, ANTIFUNGAL AND ANTIOXIDANT EFFECTS OF ARTICHOKE LEAF EXTRACT (ENGİNAR YAPRAĞI EKSTRAKTININ ANTİMİKROBİYAL, ANTİFUNGAL VE ANTİOKSİDAN ETKİLERİ)

The globe artichoke (GA), which is cultivated in a wide area in the Mediterranean regions and has an important place in the Mediterranean diet (27), is the oldest solitary plant belonging to the Asteraceae class, also known as *Cynara scolymus L.* (28).

GA leaves contains high amounts of polyphenol compounds. Therefore, interest in GA and its cultivation for pharmaceutical purposes has increased [29]. In addition to containing a high amount of water (91% of a food portions), the GA is rich in vitamins, minerals, polyphenols and carotenoids [30, 31].

Edible parts and by-products of GA are very rich in dietary fibers and polyphenols such as caffeoylquinic acids, di-caffeoylquinic acids, and flavones [32, 33]. Basic phenolics found in the composition of artichoke; cinnamic acids, chlorogenic acid, cynarin, 1,5-O-dicaffeoylquinic acid and 3,4-O-dicaffeoylquinic acid, essential flavonoids; apigenin, luteolin, Rutin and their glycosides [29, 32, 33]. These components give artichoke antioxidant, antifungal, antimicrobial and anticancer properties [34, 35, 36].

Shallan et al. [29] found that GA is a very rich source of substances, exhibiting antimicrobial, antioxidant and anticancer properties, and GA extract is an inexpensive and safe source for preventing various foodborne diseases, adding nutraceutical values to foods and promoting pharmaceutical ingredients.

Artichoke has a protective effect against bacteria such as *E. coli, P. vulgaris, S. aureus, B. subtilis* and *K. pneumonia* [29, 37].

Fratianni et al [38] searched the antimicrobial effects of GA bracts extract and reported that this extract had antibacterial activity against *P. aeruginosa, B. cereus, and E. coli,* whereas *E. faecalis* showed resistant against the extract (164).

Vamanu et al. [39] determined that GA had antimicrobial activity against seven microorganisms (*E. coli, B. cereus, L. innocua, Candida spp., S. aureus, P. aeruginosa* and *C. albicans*) tested.

Alghazeer et al. [40] reported that flavonoid extracts of GA have antibacterial activity against *B. subtilis, S. aureus, E. coli, S. typhus* and *P. aeruginosa*.

Emanuel et al. [41] and Scavo et al. [42] showed that GA leaves showed antibacterial properties (*Listeria innocua, E. coli, S. aureus, B. cereus and P. aeruginosa*) as a result of extraction with ethanol, and these values varied between 5.0 and 15.0 a mg mL^{-1} the minimum inhibitor concentration (MIC).

Zhu et al. [43] found that ethanolic extracts of heads, leaves, and stems of GA showed antifungal activity against *C. lusitaniae, C. albicans, S. carlsbergensis, S. cerevisiae, P. oxalicum, A. niger, M. mucedo,* and *C. cucumerinum* (169).

Kukic et al. [44] ethanolic extracts of the outer parts of GA have antifungal activity against *Alternaria alternata, Trichoderma viride, P. funiculosum, Fusarium tricinctum, A. ochraceus, A. niger, A. flavus, P. ochrochloron,* and the MIC values vary between 1.0 and 1.5 mg mL^{-1}.

Uluad [45] reported that artichoke leaves have high amounts of phenolic substances and high antioxidant activity.

Baş and Doğan [46] determined that artichoke had a significant amount of antioxidant capacity in its stem, leaf and bract extracts, and the highest antioxidant capacity was obtained from the bract.

3. ANTIMICROBIAL, ANTIFUNGAL AND ANTIOXIDANT EFFECTS OF GRAPEFRUIT EXTRACT (GREYFURT EKSTRAKTININ ANTİMİKROBİYAL, ANTİFUNGAL VE ANTİOKSİDAN ETKİLERİ)

Grapefruit (*Citrus paradise* L.), a subtropical plant belonging to the Rutaceae family, is known for its slightly sour and semi-sweet fruits [47]. It was first discovered on the island of Barbados in the 18th century and is reported to be a hybrid product that grows as a result of a natural cross between pomelo (*Citrus maxima (Burm)* Merr.) and sweet orange (*Citrus sinensis* L.) [48, 49].

According to the data of the United Nations Food and Agriculture Organization (FAO), the leading producers of grapefruit around the world are China and the USA. It is reported that a total of 4.9 million tons of grapefruit were produced in China in 2018 [50]. In addition to the production of grapefruit, the waste of unused parts can be very high. Ezejiofor et al., [51] produce approximately 0.3 million tonnes of citrus waste annually in Nigeria. It should be noted that the waste should be evaluated.

Grapefruit seed extract (GFSE), a natural antimicrobial substance with high levels of limonoids (limonin), flavonoids (naringenin), phenolic acids, ascorbic acid and other trace elements, is obtained from grapefruit seeds [52]. In the studies, it was determined that GFSE incorporated into various biodegradable films has high antioxidant properties and has strong antimicrobial effects against both Gram (-) and Gram (+) bacteria [53, 54].

Choi et al. [55] reported that GFSE had a broad-spectrum antimicrobial effective against many microorganisms such as *Escherichia coli, Salmonella, Candida, influenza,* herpes, and molds.

Nanoemulsions of orange, grapefruit and lemon essential oils have been shown to inhibit many microorganisms such as *Lactobacillus curvatus, Staphylococcus carnosus* and *Staphylococcus xylosus*, which are related to the decay of food, such as *E. amnigenus* and *E. gergoviae,* and these microorganisms are used as antimicrobial and antioxidant agents against various bacteria in the food industry [56, 57].

Shehata et al. [58] also found that GFPE had antimicrobial activity against *Aspergillus carbonarius* mould, and both Gram- and Gram+ bacteria, except *Yersinia enterocolitica*.

GFSE has been used to extend the shelf life and preserve of foods (especially minimally processed fruits, vegetables, and fish products) due to its antioxidant property which contains minerals, vitamins, polyphenolic compounds (catechins, epicatechin, procyanidin), flavonoids (naringin), tocopherol, limonoid, ascorbic acid and citric acid [59].

Kim et al. [60] reported that grapefruit peels may be suitable for nutritional and medical use as they contain several important vitamin C, antioxidants, carotenoids and phenolic compounds, and various bioactive compounds. Due to the increase in consumer demand for natural preservatives or antioxidants in foods, grapefruit peel powder can be used as a flavoring and preservative food additive in foods [61].

The antioxidant capacities (DPPH) of grapefruit, orange and lemon peels were compared by Singh and Immanuel [62] and it was reported that grapefruit, lemon and orange peels had the highest antioxidant activity, respectively. When Güzel and Akpınar [63] investigated the antioxidant capacity of lemon, tangerine, grapefruit and orange peels, they reported that lemon and grapefruit had higher antioxidant capacity.

4. CONCLUSION(SONUÇ)

Food waste increases as a result of not using the waste parts of foods such as bark, seeds and leaves. Today, the trend towards natural and herbal products is increasing. As a result, it is thought that herbal products can be used both as a natural preservative and in the field of consumption by reducing food waste. Considering the antioxidant, antifungal and antimicrobial properties of plants, it is estimated that they can be used as natural preservatives. Many researchers are working on this issue. In this context, antimicrobial, antifungal and antioxidant properties of grapefruit and artichoke leaf extracts were investigated. It is thought that these extracts can be used as natural preservatives. In this way, it is foreseen that the waste parts can be valued.

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CONFLICT OF INTEREST(ÇIKAR ÇATIŞMASI)

The authors declare that there is no conflict of interest regarding the publication of the paper.

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