A New Antibacterial Agent: Propolis

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Abstract

As the products are being used widely in almost part of Daily life, antibacterial textile products gain more importance. The necessity of antibacterial agents used due to the importance given to today's health and alternative products provided by natural routes has also revealed the necessity of this context. This work focuses on the usage of propolis as an antibacterial agent.

Keywords: *Propolis, Antibacteriality, Extract, Flavonoid*

I. INTRODUCTION

Because of increasing population and many other environmental effects, anti-bacterial effect has become one of the most important topic nowadays.

Instead of using chemical solutions, using natural ways has become important to get the anti-bacterial effect.

Propolis which is a bee secretion, has used in researches since the ancient times however ongoing research on its usability has still been continuing.

For health, while it can be seen the usage of bee products such as honey, glee royale and pollen yet meeting with propolis is very new.

A. Propolis

Propolis which is a matter produced by bees in order to both cover and repair their hives, means "usage of the city" in Greek

Because of their nature, all animals act according to their protective instinct against the external factors and also they all have the ability to resist the problems that they encounter.

Just like animals, many plants produce gummy matter in order to protect them against outside environmental conditions (such as cold, heat, water etc.) and microorganism invasions.

The matter called propolis that shows fragile characteristic in cold, very sticky in hot, is made by worker bees with using and blending their special secretion with plant's extract and resin. [1,2,3].

Bees use propolis in order to protect their hives from disease, get rid of the smell of the dead bees and maintain a hygienic living space.

Its usage by people dates long ago. It stated that Egyptians used propolis for mummifying and in the same time, they used it as an antiseptic and healing the wounds [4].

It is a well-known fact that lots of plants and animals participated the improvement of the science.

Similarly, it had been thought and researches had been started that if bees use the propolis in their hives, it can also be used for people with the same purpose especially for using disease protection and curing the disease Hand, it's known that due to its antioxidant feature, it protects the cells from oxidative damage. It's known that propolis is much more effective than many other vegetables and fruits and many researches had been done about this [5,6].

It has been proved in a research that propolis has 62 and 120 times more antioxidant feature than pomegranate and tomato which are known as the most effective antioxidants [7].

Propolis had gained a different importance because of being a very powerful antioxidant matter apart from fruits and vegetables.

In their work, Konig et al. worked on raw color profile of propolis and solubility in resolvents. At the end of the research they made, they found respectively that in the raw stage, the wide color range of propolis turned from yellowish green to brown, alcohol is the best resolvent which removes propolis from wax, its context changes according to the environment in which bee lives and its chemical structure hasn't been studied yet [8].

On the other hand, flavonoids which are both common in honey and propolis, an idea has brought into open That effects which are similar to honey can be gathered with using propolis [9].

B. Chemical compound of propolis

Depending on the vegetation where bees live and the time when propolis is gathered, context of propolis shows difference. It is stated that wax also effects the compound of propolis. According to these findings, it is stated that propolis consists of 180 different compounds [10].

Due to the flavonoids that are in the structure of propolis, propolis has an antibacterial effect and due to the environment where propolis is gathered, 180 flavonoids had been detected [11].

In propolis, while there are more manganese and zinc, also mercury, fluorine, nickel, sodium, potassium, chlorine, phosphorus, cobalt, silicon, molybdenum, lead, silicon, aluminum, copper and manganese are found.

There are also 8-17 different amino acids depending on the place where they group in the structure of propolis [12].

TABLE 1
Number of the compounds in propolis [2]

Compounds	**Number of the completed**

	compounds
Flavonoids	38
Hydroxy Flavon	27
Hydroxy flavonones	11
Chalcocites	2
Benzoic Acid and Its Derivatives	12
Acids	8
Esters	4
Benzaldehyde Derivatives	2
Sinamil and Sinamic Acid Derivatives	14
Alcohols, Ketones, Phenols	8
Sekuterpen and Triterpen Hydrocarbons	11
Sterols and Steroid Hydrocarbons	6
Minerals	22
Sugar	7
Amino acids	24

In many researches which were made related with the chemical compound of propolis has been detected hundreds of propolis compounds. It is stated that together with reflecting regional diversities to chemical compound where propolis obtained, basically it consists of flavonoids, phenols and various aromatic compounds. In addition, volatile oils and terpene also take part in the compound [1].

In another study, it is stated that inside the propolis, there are 12 phenolic acids, 13 flavonoids and 4 phenolic acid esters, in total 29 phenolic structures exist. (3,4-dihydroxybenzaldehyde, vanillic acid, caffeic acid, vanillin, p-cumaric acid, ferulic acid, isoferric acid, benzoic acid, 3,4- dimethoxycinnamic acid, cinnamic acid, 4- methoxycinnamic acid, dinamylideneacetic acid, benzylcafate, benzyl p-comarate, cinnamylcinnamate, 5-methoxypinobutyric acid, quercetin, alpinein, kaempferol, apigeninisorhamnetin, pinochembrine, pinobanksin-3-o-acetate, krisin, galanjin, pinostrobin, tektosiricein) [13].

It is stated that in a research that was made on the anti-bacterial effect of Turkish propolis about its characteristics in 2005, populusnigra (black poplar) and populuseuphratica (firat poplar) were identified as the most important propolis source [14,15].

It is stated in a research that propolis which was collected 12 different regions of China, except Yunnan region, all propolis has anti-oxidant characteristic and also is rich in caffeic acid, ferulic acid and caffeic acid phenyl esters. It is stated that Propolis which comes from Yunnan and Hainan regions, has compounds that doesn't have compounds which came from other regions [16].

In Sarıkaya's study, it was studied the interior structure that 2 propolis samples which collected in Turkey and was shown that 313-476 mg GAE/g is in the form of propolis. As to Yazıcıoglu, it is stated that ni 10 propolis samples, total phenolic matter quantity is 115-210 mg GAE/g [17,18].

In general, it is known that propolis consists of respectively 30% wax, 50% resin and vegetal balsam, 10% volatile oil, %5 polen and other matters. It is known that these compounds differ from vegetation and its settlement and also they have a polar structure [4].

C. Antibacterial effect of propolis

In many study, it was shown that propolis has anti-bacterial, anti-fungal, anti-viral and anti-inflammatory characteristics and the main compound which provides these characteristics is flavonoids [19,20].

It was examined in a study which was made in 2015 that anti-bacterial activity is related with different compounds and their ratios. It is indicated that as long as polar group which is in the structure of propolis, increases, anti-bacterial effect decreases and an increase of a different phenylpropanoids than caffeic acid derivative, dihydro flavon and caffeic acid, it is stated that anti-bacterial activity increases [21].

In another study, it is stated that Bee races have an influence on anti-bacterial characteristics of propolis and differences between Bee races have also crucial effect on anti-bacterial characteristic of the propolis. [22].

It is stated that propolis provide its anti-microbic effect with blocking the cell division and in this mechanism, the most effective compounds are flavonoids, cinnamylidene acetic acid, benzyl p-coumarate and esters of caffeic acid such as pinocembrin, galangin and pinobanksin [23,24,25].

In Kumova's study, it is identified that when the usage of solubilized part of propolis in 70% alcohol together with antibiotics, respectively, effects of the medications increase, shows anti-oxidative effects and it is a very powerful antiseptic which gives positive results on second degree burn treatment [26].

Kaya et al. have come to a conclusion in the study which they did in 2012 that Kayseri propolis has a high antimicrobial activity against pathogens and its usability is very high on treatments [27].

In a study which was done in 1979, it is emphasized that ethanol extracts of propolis is very effective on bone healing [24]. In a similar study has been done on rats and detected that has been effective on bone healing [28].

In a study it has been stated that the bone formation considered as histofomerical and while propolis is effective on early bone formation, it doesn't have an effect on late bone formation [29].

In a study, antioxidant activities of honey and propolis have been evaluated for total phenolic matter, Fe III, reducing power (FRAP), Cu II reducing capacity with using (CUPRAC) and DPPH radical purification capacity tests. It has been come to a

conclusion that two different Fe II and Cu II reducing tests which are used for measuring the total antioxidant capacity are parallel to each other, chestnut honey and propolis samples don't have an oxidant or pro-oxidant effect but have a reducing structure. At the same time, it has been come to a conclusion that ethanol propolis extracts has more anti-oxidant activity than methanolic extracts [30].

The result of the studies is on high effect of free-radical purification of some compounds that has been done in recent years.

In addition to flavonoids that have antioxidant characteristic such as Galangin, iso alpine, kaempferol, camphoridramnocin, ramnetin, isorhamnetin, quercetin, pinocembrin and pinobanksin, it is stated that vitamin E, histidine and active redox compounds also may take a part of the radical purification process [31].

It has been detected that quercetin, one of the effective matter of major flavonoids, shows anti-oxidant effects such as accelerating and increasing tissue regeneration, activating some of the enzymes of elderly patients [32].

Some studies also have been done over cell regeneration of propolis.

In that study, whereas amino acids (such as arginine and pyrimidine) which are in the structure of propolis transforms argineineargamat, mitotic divisions and protein synthesis increase therefore cell regeneration speed increases.

On the other hand, pyrroline which is also in the structure is being used about the synthesis of collagen and elastin [33].

Propolis is rich in CAPE (caffeic acid phenethyl ester) which is in it. It has been observed from a study which has been done on tumor injected rats that 100 days of propolis usage has suppressed the tumor growth [34].

In another study, CAPE's (caffeic acid phenethyl ester) antimetastatic effect on cancer has been evaluated [35].

Propolis is being used for strengthening the immune system, fungal problems, harmful bacteria and viral infections. For preventing and fighting with cancer, it has effective matters. It has been observed that it showed almost 100 times effectiveness comparing with common antibiotics [36].

Active matters in propolis such as flavonoids and derivations of caffeic acid block blastomycetes that cause skin diseases [37].

It is stated that propolis has also a healing effect that cures wound healing on skin, burn, inflamed wound, skin inflammation and other skin diseases and it has been reported that the most important contexts that are responsible for wound healing, are flavonoids and phenolic acids compounds [38].

In terms of the structure of the textile products, it provides one of the environments where micro-organisms can live in. It is stated that the textile products which have had their anti-bacterial characteristics gained, helped to remove these bad conditions [39].

It has been come to a conclusion that Propolis which was gathered from Elazıg region, is higly active against gram (+) and gram (-) bacteria. It is observed that propolis which gathered from other regions apart from Elazığ compared and it continued to show the antibacterial effect. For the antibacterial effect of propolis, streptomycin sulphate and ampicillin sodium were used. It has come to a conclusion that in lower concentration of propolis, ampicillin showed higher antibacterial effect than sodium [40].

In a study which had been done with the ethanol extract of propolis which was gathered from different regions of Turkey, it has been stated that propolis extract is not effective on Klebsiella pneumonia (clinical isolate) and Morganella Morganii however it showed a very powerful inhibitor effect on E. coli which is among gram (-) bacteria [41].

It has been observed that against propolis, gram (+) bacteria is more sensitive than gram (-) bacteria [42].

In the long term usage of propolis provides an advantage and forms a resistance against the harmful bacteria [43].

D. Solubility of Propolis

While its solubility is low in organic solvents, it is high ratios in alcoholic solvents [44].

Turkish propolis which was gathered from Trabzon province, was prepared its extract with water, ethanol, glycerol, acetone and DMSO and then its total polyphenol and flavonoid context, Fe III reductive strength and total antioxidant status attributions have been identified in which resolvent is the most effective. Extracts which were prepared with lyophilizing, it has been come to a conclusion that it dissolved in the most DMSO and in the least water. It wasn't sortedsSince the peaks didn't separate from each other and tailing occurred during the solvation of ethanol, glycerol and acetone [45].

In the study of Karakaş, solubility of propolis has been examined in corn oil, hazelnut oil, sunflower seed oil and olive oil. It was decided that the best solvent is the olive oil after it had been examined polyphenol context, total flavonoid context and Fe redactor strength indications. after that it was indicated that the order is respectively corn oil, hazel nut oil and sunflower seed oil [46].

III. CONCLUSION

Antibacterial effect of propolis has been examined in various studies. In general, there are records about the benefits on medical area. There are many compounds in propolis. Phenol and flavonoid ratios which are in propolis, indicate the amount of the antibacterial effect. Under favour of the propolis flavonoids, it has been showed that while it gives antibacterial characteristic against gram (+) and gram (-) bacteria, it effects positively the bone structure

with compounds such as minerals, acids, esters etc. , it was also used for important illnesses for human health such as cancer.

On the other hand, because of having the vitamin E in the structure of propolis, it shows a positive effect on skin lesions. Such a miraculous secretion has been come to the attention and researches about propolis are increasing in number day by day.

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