3rd International Propolis Conference

Propolis, Past, Present and Future Medicine

9 - 11 November 2023 İstanbul -Türkiye

IPRG

International Propolis Research Group

abstract book

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MEDİPOL UNV-SABE İSTANBUL

İSTANBUL MEDİPOL ÜNİVERSİTESİ SAĞLIK BİLİMLERİ ENSTİTÜSÜ GELENEKSEL VE TAMAMLAYICI TIP ANABİLİM DALI

APITHERAPY ASSOCIATION

James Fearnley
Co-Founder and Director

International Propolis
Research Group

Dear Friends and Colleagues,

Propolis: Past Present and Future Medicine

It is with great pleasure that I invite you, on behalf of the International Propolis Research Group, to our 3rd physical International Conference on November 9th, 10th, 11th 2023 in Istanbul.

You may remember that this conference - due to take place in Istanbul in September 2020 - was postponed because of COVID. We are delighted that Balparmak have chosen to continue as the main sponsor for this growing event.

In the past year over 1000 scientific papers have been published about propolis with nearly a third addressing the issue of antibiotic resistance. It is clear to me, that as the global problem with antibiotic resistance continues to grow, propolis has a major contribution to make.

Scientific interest in propolis has grown extraordinarily since we formed the IPRG just seven years ago. I believe the coming conference in Istanbul will reveal still more of the complex, yet powerful potential of this extraordinary substance from the beehive.

At this, our seventh-year birthday conference, we will be launching the Professor Vassya Bankova: Best Young Researcher Award, as well as honouring Professor Bankova herself for her lifetime achievement in relation to propolis.

We are looking forward to all your many and varied contributions to our understanding of propolis, whether it be as a contributor or as an observer.

Warm wishes.

Dr. Emel Damarlı

R&D and Quality Director

Balparmak R&D Center / Türkiye

Dear Colleagues and Friends,

On behalf of the Organizing Committee, it is my great pleasure to invite you to participate in the Propolis Conference – Propolis: Past, Present and Future Medicine – Istanbul 2023, to be held in Istanbul, Türkiye from 9-11 November 2023.

The conference hopes to provide a bridge between East and West, addressing key issues relevant to the study of propolis between the research and scientific communities, national and international regulatory bodies, policymakers, and consumer organizations.

The scientific program of this conference will bring propolis researchers and the Bee and Human Health community together to exchange information and discuss strategies for improving the use and health benefits of propolis through modern and sustainable production and processing technologies. This milestone event will be highlighted by plenary talks delivered by national and international experts. The conference program will also include oral and poster presentations from researchers in these fields.

We will organize social events in this beautiful city, where you will have the opportunity to meet people from around the world who share your research interests.

You will also have the opportunity to become a member of the International Propolis Research Group, which was formed after the First Propolis Conference – Propolis in Human and Bee Health Conference in Glasgow.

The location has been chosen to reflect the historical role of Istanbul as a meeting point for East and West at the crossroads of two continents and different cultures.

In the spirit of traditional Turkish hospitality, I welcome you all to Istanbul, and wish you a fruitful conference and a pleasant stay. We would like to thank you in advance for your valuable contributions and participation.

Looking forward to seeing you in Istanbul in 2023.

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APITHERAPY ASSOCIATION

Özen Altıparmak
Balparmak Chairman

Dear Scientists,

I proudly announce that we are the Main Sponsor of 3rd International Propolis Conference; Propolis, Medicine of the Past, Present and Future.

Balparmak operates in honey and bee products business for 43 years with approximately 300 employees currently. We are in contact with thousands of beekeepers in our country as the leader of this industry and we are ranked among the top 10 companies in the world. We develop innovative products and advanced analysis methods in our state-accredited R&D center with a team of 20 experienced professionals and share our scientific studies with the whole world in congresses and symposiums.

As Balparmak, our mission is; to protect the existence of bees, to support the sustainability of beekeeping and to make bee products an indispensable element of a healthy life. Since the day we were founded, we have not only been offering honey and other bee products to consumers but also working to protect the future of bees, honey and the beekeeping profession.

Bees are one of the most important creatures that make the world sustainable. The benefits offered by bees, which produce honey as much as the tip of a teaspoon throughout their lifetime, are so many than we can imagine.

That is why we say **"IF THERE ARE BEES, THERE IS ALWAYS A FUTURE"**.

3rd International Propolis Conference 2023, which brings scientists has a great importance for the development of our sector. I believe that we will leave this conference with important information and that the conference will make important contributions to the development of the sector, and I wish a productive conference for all of us.

ABOUT THE CONFERENCE

The scientific program of the 3rd International Propolis Conference on “Propolis, the Medicine of the Past, Present and Future”, which will be held in Istanbul, Türkiye between 9-11 November 2023, will bring together researchers working especially on the bioavailability of propolis and propolis in the field of apitherapy. It will enable scientists to exchange information and discuss strategies to improve the use of propolis. The conference, which aims to create a bridge between the East and the West, will include oral and poster presentations, and the main issues related to propolis studies will be discussed among national and international scientists, decision makers and consumer organizations.

The city of Istanbul, which is the meeting point of two continents and different cultures and reflects Türkiye’s historical role, was chosen as the venue of the conference. We wish you a productive conference and a pleasant experience in this beautiful city where you will have the opportunity to meet expert scientists from all over the world. We thank you in advance for your valuable contributions and participation and welcome you all in the spirit of traditional Turkish hospitality.

“Professor Vassya Bankova, Young Researcher Award” Will Find Its Owner!

On the closing day of the 3rd International Propolis conference, a pleasant moment will be witnessed and the “Professor Vassya Bankova Young Researcher Award” will be met with its winner. You can reach all the details to apply for this valuable award by clicking on the link. Applications can be made by e-mail bankova.award@iprg.info until 12:00 noon on September 7, 2023 UK time.

SCIENTIFIC COMITTEE CHAIRMAN

Prof. Sibel Silici
Faculty Member; Erciyes University Department of Agricultural Biotechnology Kayseri-Türkiye

SCIENTIFIC COMITTEE MEMBERS

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Laboratory Technical Manager
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President of Turkish Apitherapy Association President of International Apitherapy Federation, Medipol University, Istanbul-Türkiye

Prof. Vassya Bankova
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R&D and Quality Director,
Balparmak R&D Center/Türkiye

James Fearnley
Nature's Laboratory Ltd. Chairman of the Board,
Whitby-England

Dr. Mike Simone-Finstrom
Research Molecular Biologist
U.S. Department Agriculture

Dr. Stefan Stângaciu
Romania President of Apitherapy, Phytotherapy, Aromatherapy Association - Secretary General of International Apitherapy Federation, Dambovita-Romania

Prof. Miguel Vilas-Boas
Faculty Member; Bragança Polytechnic Institute, Portugal

David Watson
Faculty Member, University of Strathclyde/United Kingdom

GUEST OF HONOR

Prof. Vassya Bankova
Faculty Member; Institute of Organic Chemistry, Center for Phytochemistry, Bulgarian Academy of Sciences, Sofia-Bulgaria

KEYNOTE SPEAKER

Dr. Ali Timuçin Atayoğlu
President of Turkish Apitherapy Association
President of International Apitherapy Federation, Medipol University, Istanbul-Türkiye

Dr. Andressa Berreta
Head of R&D at Apis Flora Limited, Co-Founder of AgroBee, Head of ISO Propolis Working Group, Brazil

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Dr. Mike Simone-Finstrom
Research Molecular Biologist
U.S. Department Agriculture

Prof. Noureddine Djebli
Director of the Pharmacognosy Api-Phytotherapy Laboratory Department of Biology, Faculty of SNV, Mostaganem University

THURSDAY

12:00-17:00	**Registration**
12:00-13:30	**Welcome Cocktail**
13:30-14:30	**Official Opening Ceremony** Moderator: Emel Damarlı
14:30-15:10	**Exploring the Geographical and Bee Species Influences on Stingless Bee Propolis** Vassya Bankova
15:10-15:30	**Coffee Break**

Moderator: Emel Damarlı

15:30-16:10	**Propolis: Past, Present and Future Medicine** James Fearnley
16:10-16:50	**Propolis Scientific Studies in the Last 20 Years Around the Globe** Ali Timuçin Atayoğlu
16:50-17:30	**The Effect of Propolis in Pregnant Nutrition** Sibel Silici
17:30- 17:50	**BeeArc – Social, Cultural and Economic Renewal – Inspired by the Honeybee** James Fearnley
19:30-00:00	**Gala Dinner**

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FRIDAY

Moderator: Sibel Silici (09:00-11:00)

09:00-09:40	**Uses of Different Forms of Propolis in Clinical Medicine; Methods, Rules and Guidelines** Stefan Stangaciu
09:40-10:00	**Plant Sources of Propolis in Iran** Mohammad Refahi
10:00-10:20	**Foodomics Approaches for Understanding the Gastrointestinal Protective Effects of Bee Propolis** Kai Wang
10:20-10:40	**The Anti-Inflammatory Properties on Raw 264.7 Cell Lines and Bioactive Compounds of Indonesian Propolis from Four Stingless Bee Species** Muhamad Sahlan
10:40-11:00	**Water-Based Propolis Enhances the Anticancer Activity of 5-Fluorouracil, a Chemotherapy Drug** Muhsin Atilla Göksoy
11:00-11:20	**Coffee Break**

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FRIDAY

Moderator: Vassya Bankova (11:20-13:00)

11:20-11:40	**Quality Assessment of Global Propolis Samples Using Chemical Profiling Through HPLC and GC-MS** Bhagyashree Kamble
11:40-12:00	**New Green Propolis Extract Formulations as Promising Candidates to Substitut Hydroalcoholic Extract** Andresa A. Berreta
12:00-12:20	**Medicinal Forms and Therapeutic Uses of Iranian Propolis** Mohsen Fathi Najafi
12:20-12:40	**Propolis from Omani Plants** Hassan Al-Lawati
12:40-13:00	**Importance Of Botanical Source Identification For Propolis Standardization** Etil Güzelmeriç
13:00-14:20	**Lunch**

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FRIDAY

Moderator: Andressa-Berretta (14:20-16:00)

14:20-14:40	**Influence Of Shading Hives on Green Propolis Production and Quality in the Northeastern Brezilian Caatinga Brasil** Jéssica Aparecida de Lima
14:40-15:00	**Chemical Composition of Honey and Propolis from the Stingless Bee Scaptotrigona Mexica** Milena Popova
15:00-15:20	**Investigation of the Effect of Propolis Extraction Conditions on Bioactive Components** Oktay Yıldız
15:20-15:40	**A Study Shelf Life of Propolis Extracts Based on Bioactive Properties** Oktay Yıldız
15:40-16:00	**Determination of Wax Content of Olive-Oil Propolis Extracts Prepared Under Different Conditions** Nesrin Ecem Bayram
16:00-16:20	**Coffee Break**

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FRIDAY

Moderator: Timuçin Atayoğlu (16:20-18:20)

16:20-16:40	**Comparative Flavonoid Profiling of Middle Eastren, African, and European Propolis Samples and its Correlation with Their Therapeutic Potential** Samra İhsan
16:40-17:00	**Propolis Mechanisms and Effects in Depression and Anxiety, from Literature to Practice** Ramona-Niculina Jurcău
17:00-17:20	**Bisphenol a Risk in Propolis** Miray Dayıoğlu
17:20-17:40	**The Development of Topical Products from Indonesian Stingless Bee Propolis: Therapeutic and Cosmetic Applications** Felix Zulhendri
17:40-18:20	**Propolis Promotes Social Homeostasis in Honey Bees and Supports Mite Resistant Behaviors** Michael Simone-Finstrom
18:20-20:00	**General Assembly of IPRG**

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SATURDAY

Moderator: James Fearnley (09:00-11:20)

09:00-09:40	**Propolis International Standard Proposed by ISO – an Important Regulatory Framework for Authenticity and Quality Remarks of the Propolis International Market** Andresa A. Berretta
09:40-10:20	**Film and Coating Innovation: Harnessing the Power of Propolis** Miguel Vilas-Boas
10:20-10:40	**Amount of Individual Phenolic Compounds in Commercial Propolis Products, Quality and Standardization** Hasan Hüseyin Oruç
10:40-11:00	**The Main Factors Affecting the Quality of Honey Bees' Life and Products** Devrim Oskay
11:00-11:20	**Coffee Break**

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SATURDAY

Moderator: Stefan Stangaciu (11:20-13:00)

11:20-12:00	**Chemopreventive and Chemotherapeutic Effect of Propolis on Cancer** Abdurrahim Koçyiğit
12:00-12:20	**Evaluation of the Biochemical Parameters and Histological Study of the Antidiabetic Effect of Propolis "In Vivo Study in Wistar Rats"** Prof. Noureddine DJEBLI
12:20-12:40	**Water-Based Propolis Prevents Protein Oxidation in Fission Yeast Grown at High Glucose Concentration** Nazlı Arda
12:40-13:00	**Antiviral Activity of Propolis Against SARS-CoV-2 Infection in Real-Time in Vitro Cell Studies** Müge Serhatlı
13:00-14:20	**Lunch**

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Moderator: Miguel Vilas-Boas (14:20-15:40)

14:20-14:40	**Exploring the Diverse Properties of Propolis: A Multidisciplinary Approach** Astrid Sarapa
14:40-15:00	**Overview of Bee Propolis Industry in China** Xuan Li
15:00-15:20	**Evaluation of The Botanical Sources, Chemical Components, and Bioactivity Profiles of Several Propolis Samples Collected from Black Sea Region (Turkiye)** Nisa Beril Şen
15:20-15:40	**Optimization of Propolis Extraction with Natural Deep Eutectic Solvents and Evaluation of Their Bioactive Content and Antimicrobial Activity** Ufuk Alpat
15:40-16:00	**Multivariate Analysis of Correlation Between Chemical Composition and Biological Activity of Propolis** Shankar Katekhaye
16:00-16:20	**Coffee Break**

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SATURDAY

Moderator: Nazlı Arda (16:00-17:00)

16:20-16:40	**A Chewable Lozenge with Propolis as a Promising Cariostatic Agent Dosage Form** Anna Kurek-Górecka
16:40-17:00	**Propolis Shows Antiatherogenic Activity by Reducing ADAM10 and Sortilin Levels in the Aortic Root** Ertuğrul Yiğit
17:00-17:20	**Chemical and Bioactivity Studies on a New Type of Propolis Botanically Originated from Cistus laurifolius** L. Ecesu Sezen
17:20-17:40	**Propolis and Drug Interactions** Sibel Silici
17:40-18:40	**Closing Ceremony**
18:40-21:30	**Closing Cocktail**

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ORAL PRESENTATIONS

Exploring the Geographical and Bee Species Influences on Stingless Bee Propolis

Vassya Bankova, Milena Popova[1], Boryana Trusheva[1]

[1] Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Acad. G. Bonchev bl. 9, 1113 Sofia, Bulgaria

Abstract

The importance of the bee species for the chemical profile of stingless bee propolis and the species specificity of the plant sources used by bees for propolis production have not yet been clarified in depth. Here we summarize the data obtained by parallel studies on propolis of different stingless bee species collected in the same region, and propolis of the same species collected in different regions. Such data concerning Brazilian, Vietnamese and Mexican stingless bees have been discussed, trying to find out the influence of species and location on the chemistry of propolis. Interestingly, in some cases bees of different species in the same region collect propolis with identical chemical profiles making use of the same plant resins. In other cases, however, bees of the same species produce chemically different propolis even if the hives are as close 8.5 km away. These facts indicate that the entomological origin cannot be considered the main factor that determines the characteristics of propolis. It seems that there are bee species with definite preferences for a given plant source, while others are more opportunistic in this respect. Further studies are needed to clarify whether species-specific bee preferences or local flora and climate are more important for the chemical composition of stingless bee propolis. Obviously, the study of Meliponinae propolis is even more challenging than the study of honeybee propolis. Information on the chemical composition of propolis of these native bees, as well as the plants they visit as sources of resin, is of great importance, both for conservation purposes and for meliponiculture.

Key Words: **Stingless Bees, Chemical Profiles, Propolis Plant Sources, Species Specificity**

Propolis: Past, Present and Future Medicine

James Fearnley

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Abstract

As we discover more about the relationship between the chemical and biological activity of propolis from different geographical zones, so we can begin to see that the medicinal properties of propolis for human beings are related to same or similar functions of propolis for the honeybee. So, for example propolis from climatic zones characterized by high temperatures and high humidity are found to have higher antimicrobial values than propolis from temperate zones. Propolis from temperate zones contain higher flavonoid concentrations which carry with them higher antioxidant/ anti-inflammatory properties. Clearly the plants are adjusting to their environment via the evolution of their own immune defence mechanism, expressed in their purest form in the resins visible at growing points or through injury. The collection by the honeybee of specific local resin sources carries forward the plants immune defence complex into the beehive where this raw material is adapted for use by the superorganism. This concept of relatedness was always a feature of the ancient understanding and definition of medicine. We can note Hippocrates' reference to medicine as three dimensional when he describes medicine as an art derived from the unique relationship between, the patient, the disease, and the doctor. With the dawn of the scientific era around the 16th Century the concept of medicine underwent a redefinition to a more one-dimensional cause and effect, single active, targeted, synthetic physical substance form what we now know as pharmaceuticals. This presentation will illustrate both the benefits and the burdens of the move away from a more related, artistic, and three-dimensional concept of medicine. It will also show how both science and public opinion are moving back to a more local, functional, ecological understanding of medicine Research into the chemistry and related biology of propolis is providing an interesting and exciting model of this evolving three-dimensional model.

Key Words: **Propolis – Three Dimensional – Ecological – New Medicine**

The Effect of Propolis in Pregnant Nutrition

Sibel Silici

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Abstract

The use of food supplements becomes important due to the limitation of drug use during pregnancy. The most frequently used food supplements in this process are herbal products. However, negative effects of herbal products such as inhibiting fetal growth, having a teratogenic effect, causing high blood pressure, and causing blood clotting problems have also been reported. It is thought that honey bee products will be beneficial during pregnancy with their rich nutritional content. Propolis emerges as a bee product preferred by pregnant women due to its immune system strengthening effect. The number of scientific studies on the use of bee products during pregnancy is quite low. Although there are few studies, it is reported that high doses of propolis, ethanol and glycol extracts will have negative effects. However, it has also been reported that low dose ethanol extract, water and edible oil extracts may have a positive effect. Therefore, more scientific studies are needed on this important period.

Key words: **Pregnancy, Propolis, Side Effects, Ethanol, Glycol**

1. Introduction

Pregnancy is a period in which various maternal hormones are secreted and metabolic changes occur to ensure optimal fetal development. In this period when the woman is preparing for the physical and physiological requirements of being a mother, it is important to meet the need for micronutrients as well as the need for macronutrients (Grattan, 2011). During pregnancy, the need for micronutrients increases due to changing physiology and homeostatic control (Picciano, 2003). The increase in vitamin-mineral and herbal supplement products used during pregnancy shows that the use of complementary and alternative medicine methods is increasing (Maats and Crowther, 2002).

The food supplement industry in the world is growing day by day. According to the definition of the US Food and Drug Administration, food supplement; It is expressed as a product intended to support the diet or as a vitamin, mineral, herb or plant-derived substance, amino acid, concentrate, metabolite component or extract (FDA, 2015). One of the groups where food supplements are reported to be frequently used is pregnant women (Gibson et al. 2001). Studies have reported that the frequency of herbal supplement use during pregnancy is 18-36%, while the rate of multivitamin-mineral supplement usage is 40-91% (Bercaw et al. 2010). Many physiological changes such as nausea and insomnia that

occur during pregnancy have led to the need to find a safer solution than using medication. Although there is not much information about the safety of using herbal products during pregnancy, the use of food supplements is increasing day by day due to environmental factors, the knowledge that plants are of natural origin, and the fact that drugs can be teratogenic. While some pregnant women use nutritional supplements with the advice of healthcare professionals, some of them use them at their own request or with the advice of their relatives. Although there is insufficient information about the use of food supplements during pregnancy, their intended use, and the possible harms of these supplements, these products may have side effects such as teratogenicity, miscarriage or premature birth, and interaction with other drugs used during pregnancy (Dugoua, 2010).

For example, it has been reported that some commonly consumed natural products such as ginseng, ginger and ginkgo bloba inhibit fetal growth, and green tea increases teratogenesis (Mohammed et al. 2016; Park et al. 2009). Scientific studies have reported that some natural products with anticarcinogenic effects, such as ginger, gingko biloba and ginseng, are also teratogenic (Muhammed et al., 2016). Use of these products in high doses has also caused teratogenic effects. It should also be noted that the use of herbs containing coumarin derivatives, such as chamomile, may pose a potential danger to women experiencing coagulation disorders during pregnancy (Johns and Sibeko, 2003).

According to the results of the Türkiye Nutrition and Health Survey (TBSA 2010), it is seen that the most used nutritional supplement during pregnancy in our country is iron with 43.5%, followed by the use of multivitamin minerals (27.1%) and folic acid (15.1%) (15). In the study conducted by Maats et al. (2002) with 211 pregnant women to determine women's use of vitamins, minerals and herbal supplements before pregnancy and during pregnancy, the most used vitamin and mineral supplement in the last period of pregnancy was iron (27.0%), followed by multivitamins (18.0%) and folate (18.0%) supplementation. In this study, similar results were obtained by observing that the most commonly used supplements were multivitamin, iron and folic acid, respectively. Although it is thought that bee products such as bee pollen, perga and royal jelly can be used for this purpose, there are almost no scientific studies.

A few studies on the use of propolis, a bee product, during pregnancy have been conducted on experimental animals. For example, Fikri et al. (2019) analyzed the effect of propolis application on fetal development for 18 days during pregnancy. They found that high doses of propolis water and ethanol extract (1400 mg/kgbw) significantly reduced fetal weight compared to the control group. However, they found that the ethanol extract significantly reduced crown-rump length. They found no difference in the number of live and dead fetuses, pre- and post-implantation embryo loss, and placenta weight among all tested groups. While fetal weight is considered the main parameter to evaluate developmental toxicity, crown-rump length is another parameter to examine fetal development (FDA, 2005; Hoberman and Lewis, 2017). According to this information, it can be said that high doses of propolis may prevent fetal development. It has also been reported that high doses of propolis increase the number of late resorptions. One of the causes of resorption may be immune

rejection. As a matter of fact, increased macrophage activity and increased production of No and TNF-alpha in the endometrium during pregnancy can be toxic for embryo development (Baines et al. 1997). While bone ossification is a parameter indicating the maturity of fetal development (Gentili et al. 1984), high-dose EEP was characterized by a lower weight fetus and crown-rump and delayed bone ossification. Again, it was determined that high dose fetuses were younger than 18 days old, relatively shortened ossification in the supraoccipital bone, and ossification thickness in the caudal bone decreased. As a result, regardless of the origin of propolis, it has been reported that pregnant mice are more tolerant to the water extract of propolis than to the ethanol extract. This is attributed to the fact that the main components of the water extract are carbohydrates and terpenes, while its phytochemical composition is less concentrated than the ethanol extract, thus its tolerance is high (Fikri et al. 2019). In the study analyzing the effect of propolis (Indonesia; Tetragonula laevicep) consumption during pregnancy on maternal liver and kidney; They found that both propolis extracts (water and ethanol) did not reduce maternal weight gain and did not cause significant changes in serum ALT, AST, urea and creatine levels. They did not detect any specific changes in both liver and kidney histological findings (Fikri et al. 2021). Usman et al. (2018) evaluated the effects of propolis obtained from stingless bees (Heterotrigona itama) alone or combined with insulin (for 4 weeks) on maternal status, pregnancy outcomes and placental oxidative stress in streptozotocin-induced diabetic rats. In the study in which ethanol and water extracts of propolis were used, fasting blood sugar, gestation period, implantation losses, fetal blood sugar, and placental oxidative stress markers such as malonaldehyde and protein carbonyl were significantly higher in the diabetic group compared to the non-diabetic groups, while maternal weight gain, fetal body weight and weight gain were significantly higher in the diabetes group. weight and total antioxidant capacity were found to be significantly lower. It was determined that the negative effects caused by diabetes were improved in the propolis and insulin groups, and this positive effect was higher in the combined group. Wibowo et al. (2021) reported that the use of propolis (1.8 mg-7.2mg/200g/bw) for 20 days during pregnancy in rats improved oxidative stress parameters (malondialdehyde, 8-Oxo-2â€²-Deoxogunosine levels) and maternal body weight and average number of pregnancies. They tested its effect on It was determined that propolis caused a significant decrease in MDA and 8-OHDG levels and an increase in maternal body weight and average number of fetuses. In a recent study, Silici et al (2023) tested propylene glycol, water and olive oil extracts of propolis during the pregnancy period of experimental animals. In hematological and biochemical analyses; It was determined that the blood lipid levels of triglyceride, cholesterol and LDL-cholesterol were higher and HDL-cholesterol levels were lower in the groups given propylene glycol extract of propolis compared to the control and other trial groups. Liver enzyme levels of these groups were also found to be significantly higher than other groups. However, no negative effects of water and oil extracts were observed during this period.

2. Results and Discussion

While vitamin and mineral supplements are used to meet the increasing micronutrient requirements during pregnancy, propolis is used as an immune system supporter to treat or prevent health problems. Although literature information on the use and possible side effects of bee products is

limited, there are concerns about their safety during pregnancy. These effects include adverse health consequences on fetal development and possible drug interactions. The reliability and effectiveness of nutritional supplements, which have begun to be widely used for the prevention and treatment of some problems that occur during pregnancy, should be evaluated by healthcare professionals, and the effects of nutritional supplements on the mother and fetus during pregnancy should be investigated in future studies.

References

[1] Baines, M.G., Duclos, A.J., Antecka, E., Haddad, E.K., (1997). Decidual infiltration and activation of macrophages leads to early embryo loss. Am. J. Reprod. Immunol. 37 (6), 471–477.

[2] Bercaw, J., Maheshwari, B., Sangi-Haghpeykar, H.(2010). The use during pregnancy of prescription, over-the-counter, and alternative medications among Hispanic women. Birth., 37, 211–218.

[3] Dugoua, J.J.(2010). Herbal medicines and pregnancy. J Popul Ther Clin Pharmacol., 17, e370-378.

[4] Fikri, A.M., Sulaeman, A., Handharyani, E., Marliyati, S.A., Fahrudin, M. (2019). The effect of propolis administration on fetal development.Heliyon 5, e02672.

[5] Fikri MA; Sulaeman A, Marliyati SA, Fahrudin M. (2021).Effect of propolis on maternal toxicity. Pharmaceutical Sci Asia, 48(3), 224-230.

[6] Food and Drug Administration. What is a dietary supplement? Aug 6, 2015. Available at http://www.fda.gov/AboutFDA/Transparency/Basics/ucm195635.htm Accessed August 27, 2015.

[7] Food and Drug Administration [FDA], 2005Food and Drug Administration [FDA], 2005. Guideline for Industry: Detection of Toxicity to Reproduction for Medicinal Products & Toxicity to Male Fertility, (ICH) S5(R2)

[8] Grattan, D. A. (2011). Mother's Brain Knows. J Neuroendocrinol., 23, 1188–1189.

[9] Gibson, P.S., Powrie, R., Star, J.(2001). Herbal and alternative medicine use during pregnancy: a cross-sectional survey. Obstet Gynecol., 97, 44–45.

[10] Gentili, P., Trasimeni, A., Giorlandino, C.(1984). Fetal ossification centers as predictors of gestational age in normal and abnormal pregnancies. J. Ultrasound Med. 3 (5), 193–197.

[11] Hoberman, A.M., Lewis, E.M. (2017). Juvenile toxicology testing. Reproductive and Developmental Toxicology, second ed., pp. 129–144.

[12] Maats, F.H., Crowther, C.A. (2002). Patterns of vitamin, mineral and herbal supplement use prior to and during pregnancy. Aust N Z J Obstet Gynaecol., 42, 494-496.

[13] Picciano, M.F. (2003). Pregnancy and lactation: physiological adjustments, nutritional requirements and the role of dietary supplements. J Nutr., 133, 1997S–2002S.

[14] Silici, S., Okan, A., Köklü, B., Demiray, S., Doğanyiğit, Z. (2023). Toxicity of propylene glycol extract of propolis on central nervous system and liver in pregnant and neonatal rats. Zeitschrift für Geburtshilfe &Neonatale 227(04), 261-268.

[15] T.C. Sağlık Bakanlığı Sağlık Araştırmaları Genel Müdürlüğü, Hacettepe Üniversitesi Sağlık Bilimleri Fakültesi Beslenme ve Diyetetik Bölümü, Ankara Numune Eğitim ve Araştırma Hastanesi. Türkiye Beslenme ve Sağlık Araştırması 2010: Beslenme Durumu ve Alışkanlıklarının Değerlendirilmesi Sonuç Raporu. Sağlık Bakanlığı Yayın No: 931, Ankara 2014

[16] Usman, U.Z., Bakar, A.B.A., Mohamed, M. (2018). Propolis improves pregnancy outcomes and placental oxidative stress status in streptozotocin-induced diabetic rats. BMC Complement Altern Med 18, 324.

[17] Wibowo WW, Fasitasari M, Zulaikhah ST. Effect of propolis extract supplementation during pregnancy on stress oxidative and pregnancy outcome: Levels of Malondialdehyde, 8-Oxo-2â€²-Deoxogunosine, Maternal body weight, and number of fetuses. Journal of Kedokteran Brawijaya 2021; 31(3):

The BeeArc: Social, Cultural and Economic Renewal – Inspired by the Honeybee

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Abstract

The discovery by a research group at the University of Strathclyde that propolis from subtropical zones had stronger anti microbial properties and that propolis from temperate zones greater anti oxidant activity led to the founding of the Apiceutical Research Centre in the UK in 2011.

ARC set out to explore the concept of Geographic Medicine through a project: BeePharma Africa – Local help for Local Health.

For the honeybee, propolis is a unique three-dimensional physical, social, and pharmacological immune defence system i.e., a unique ecological balance of its geographic environment (external physical), its social organisation and its inner pharmacological or adaptogenic functioning.

For Hippocrates human medicine had a similar three-dimensional quality when he spoke of medicine as an art involving the relationship between the disease (the physical) the patient (the social) and the doctor (understanding or knowledge). Rudolf Steiner the Austrian Philosopher writing in 1923 echoes Hippocrates “A real medicine can only exist when it penetrates into a knowledge which embraces the human being in respect to body, soul and spirit.” Health in all contexts whether it be ecological, individual or social and organisationsal involves maintaining a unique balance of these three essential components. Disease involves the over domination of one element above all others.

The BEEARC recognizes that the honeybee is facing multiple stress facrors which at its most critical casues the total collapse of immune regulation within the hive - Colony Collapse Disorder. Human beings too are facing a critical complex of social, economic, environmental and cultural stresses. Could human beings be facing Community Collapse Disorder. The BeeArc Project is exploring the social, economic and cultural vulnerability of both the honeybee, nature and the human being in a threefold project to create a Discovery Centre, A Research Institute and a Craft Community.

Key Words: **Colony Collapse, Community Collapse, Three-Dimensional.**

Uses of Different Forms of Propolis in Clinical Medicine. Methods, Rules, and Guidelines

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Abstract

Objectives:

To present the main forms of propolis, as extracts, preparations and products that can be administered through all anatomical ways, to prevent and treat diseases located in every possible part of the body.

Methods:

Didactical classification of all forms of propolis I found in the last over 30 years in the 58 countries I visited personally. Internet was also an important source of finding the best images related to the propolis preparations and products used in Human and Veterinary Medicine, but also in Sport Medicine and in Cosmetics. Study of the main methods of administration, the rules and guidelines of an effective use of propolis has been made too, based on my own practice, but also on propolis related books, booklets, abstracts, articles, and conferences organized in the last 30 years.

Results:

Over 30 forms of propolis preparations and products, that can be adapted to the administration through all anatomical ways have been found.

Conclusions:

There is an amazing number of propolis extracts, preparations and products that really can fulfill, with enough creativity when needed, all needs of a health practitioner and/or cosmetician.
However, when one looks to the practical use of these propolis forms, in various countries, one sees that most of the health practitioners are using only a few of the propolis types, mainly the propolis tincture. A good propolis practitioner should have at his/her disposal the full range of high

quality propolis preparations and products to be able to get a faster healing/improvement of various conditions/diseases.

Key Words: **Extracts, Preparations, Anatomical Ways, Doses, Guidelines.**

Plant Sources of Propolis in Iran

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Abstract

According to the latest botanical information, there are about 9500 native plant species growing in Iran, in addition, more than 3000 non-native species and cultivars have been cultivated in Iran during the last few hundred years, among which some of these species are used in the production of gum and resin. they are valuable and are used by honeybees to produce propolis. precise identification of plants producing resin in every district is essential because all propolis physical and chemical properties such as color, taste, odor, active ingredients, and its medical properties are affected by resin kind and origin. the aim of this study was to introduce plants producing valuable resin in beekeeping in Iran. according to scientific and field researches at the level of Iranian apiaries, Iranian propolis has been reported in different colors of yellow, green, white, red, dark brown and generally olive green. Plant species from the Cupressaceae, Pinaceae, Salicaceae, Betulaceae and Umbelliferae families are the most important sources of gum and resin in Iran, which are important in the preparation of bee propolis. In this research, the species of Ferula gummosa, Ferula assa-foetida, Dorema ammoniacum, Betula pendula, Pistacia atlantica, Fraxinus excelsior, Juniperus excelsa, Pinus eldarica, Populus nigra ana Salix alba were recognized as the most important sources of propolis in Iran and the samples The propolis of these plants was kept in the laboratory for further research.

Key Words: **Iran, Honeybee, Resin, Gum, Propolis**

References

[1] Bankova, Vassya & Bertelli, Davide & Borba, Renata & Conti, Bruno & I.B.S, Cunha & Danert, Carolina & Eberlin, Marcos & Falcão, Soraia & Isla, María & Moreno, María & Papotti, Giulia & Popova, Milena & Santiago, Karina & Salas, Ana & Sawaya, Alexandra & Schwab, Nicolas & Sforcin, José & Simone-Finstrom, Michael & Spivak, Marla & Zampini, Catiana. (2016). Standard methods for Apis mellifera propolis research. Journal of Apicultural Research. 58. 1-49. 10.1080/00218839.2016.1222661.

[2] Bogdanov, Stefan. (2016). Propolis: Origine, Production, Composition. Bee Product, Science.

[3] Bankova V.S., de Castro S.L., Marcucci M.C. (2000) Propolis: recent advances in chemistry and plant origin, Apidologie 31, 3–15.

[4] Refahi, M., Alipour, M., 2018. Beeplants of Iran, (Zareeh Aftab, Mashhad, Iran), 464 p. in Persian

[5] Refahi, M., Alipour, M., Hosseini, F. 2021. Knowledge of bee products. (Zareeh Aftab, Mashhad, Iran), 248 p. in Persian

Foodomics Approaches for Understanding the Gastrointestinal Protective Effects of Bee Propolis

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Abstract

Plant polyphenols are valuable sources of natural antioxidants and prebiotics. Bee propolis, among the most extensively studied health-promoting foods, contains a wealth of polyphenolic compounds. Nonetheless, there remain knowledge gaps concerning the compositional variations between different types of propolis and their bioequivalence. Foodomics, an emerging field integrating various omics technologies (genomics, proteomics, metabolomics, and transcriptomics), offers a comprehensive explanation of the mechanisms underlying the actions of these functional foods, like propolis.

To gain a holistic understanding of the gastrointestinal protective effects of bee propolis, a series of studies were conducted, demonstrating that dietary supplementation with polyphenol-rich propolis from diverse geographic origins (China and Brazil) yields beneficial effects on the human gastrointestinal tract, promoting intestinal health and preventing intestinal diseases. Experimental models, including cell cultures (human intestinal epithelial Caco-2 cells), animal models (Dextran Sulfate Sodium-Induced rodent Colitis), and gut pathogenic bacteria models (Clostridium perfringens), were employed to investigate their modulatory effects on the gut.

Crucially, these studies encompass an overview of foodomics technologies employed to identify active polyphenol components within propolis, as well as a comprehensive summary of the gastrointestinal protective effects of polyphenols using foodomics approaches. Foodomics, by combining multiple analytical platforms and data processing techniques, provides copious data and a more profound understanding of the molecular-level interactions between propolis polyphenols and the gastrointestinal tract. This foundation paves the way for further exploration of the protective mechanisms of other polyphenols on the gastrointestinal system.

Key Words: **Propolis, Polyphenols, Foodomics, Gastrointestinal Tract**

Acknowledgements

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References

[1] Wang K, Jin X, Li Q, Sawaya ACHF, Le Leu RK, Conlon MA, Wu L, Hu F (2018) Propolis from Different Geographic Origins Decreases Intestinal Inflammation and Bacteroides spp. Populations in a Model of DSS-Induced Colitis. Molecular Nutrition & Food Research 62: 1800080

[2] Zhang W, Qi S, Xue X, Al Naggar Y, Wu L, Wang K (2021) Understanding the Gastrointestinal Protective Effects of Polyphenols using Foodomics-Based Approaches. Frontiers in Immunology 12: 671150

[3] Zheng X, Al Naggar Y, Wu Y, Liu D, Hu Y, Wang K, Jin X, Peng W (2023) Untargeted metabolomics description of propolis's in vitro antibacterial mechanisms against Clostridium perfringens. Food Chemistry 406: 135061

[4] Wang K, Jin X, You M, Tian W, Leu RKL, Topping DL, Conlon MA, Wu L, Hu F (2017) Dietary Propolis Ameliorates Dextran Sulfate Sodium-Induced Colitis and Modulates the Gut Microbiota in Rats Fed a Western Diet. Nutrients 9: 875

[5] Wang K, Jin X, You M, Tian W, Leu RKL, Topping DL, Conlon MA, Wu L, Hu F (2017) Dietary Propolis Ameliorates Dextran Sulfate Sodium-Induced Colitis and Modulates the Gut Microbiota in Rats Fed a Western Diet. Nutrients 9: 875

The Anti-Inflammatory Properties on Raw 264.7 Cell Lines and Bioactive Compounds of Indonesian Propolis from Four Stingless Bee Species

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Abstract

Propolis is a resinous substance collected by bees to provide physical and biochemical protection to the nests. Recent scientific research shows that propolis' therapeutic properties are due to the presence of plant secondary metabolites. Several studies have found that propolis has a variety of properties, one of which is an immunomodulatory property that can be assessed and observed through anti-inflammatory properties. The objective of the research was to investigate the anti-inflammatory activity and the bioactive compound of Indonesian stingless bee propolis from four species Geniotrigona thorasica, Heterotrigona itama, Tetragonula clypearis, and Tetragonula biroi. The anti-inflammatory properties were determined using LPS-induced RAW 264.7 macrophages cells to measure inhibitory activity of propolis on production of tumor necrosis factor-alpha (TNF-α) and nitric oxide (NO). The phytochemical compounds of anti-inflammatory markers in propolis were analysed by using LC-MS/MS. The anti-inflammatory test results revealed that propolis of G. thorasica had the highest anti-inflammatory property at 100 µg/mL, as evidenced by TNF-α levels of 248.9 ± 2.9 pg/mL with 76.24 % inhibition and NO 6.09 ± 0.08 µmol/L with 92.74 % inhibition.

LC-MS/MS experiments of G. thorasica propolis identified eight anti-inflammatory compounds, including β-mangostin, Garconone D, Garcinone E, DL-Stachydrine, Betaine, Salvinorin-A, Mangostin, dan 18-β-Glycyrrhetinic acid. It can be concluded that the Indonesian stingless bee propolis possess anti-inflammatory properties related to the inhibition of TNF-α and NO production by macrophages. Propolis with its inflammation-modulating properties could play a role in regulating the components of the immune system, due to its content of plant secondary metabolites such as phenolics and terpenoids.

Key Words: **Anti-inflammatory, Indonesian propolis, RAW 264.7, Stingless bee, LC-MS/MS**

Acknowledgements

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Water-Based Propolis Enhances the Anticancer Activity of 5-Fluorouracil, a Chemotherapy Drug

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Abstract

In recent years, intensive research has been carried out on propolis. Besides its anti-inflammatory, antibacterial, antiviral, antimicrobial, antioxidant, and hepatoprotective properties, propolis has been found to have antiproliferative and anticancer activity in various cancer cells.

The aim of the current study was to investigate the anticancer activity of water-based propolis (WBP), alone and in combination with a chemotherapy drug, 5-fluorouracil (5FU).

First, the effects of different concentrations of WBP and 5FU on the viability of AGS human gastric cancer and Caco-2 human colon cancer cells were investigated through an MTT assay. A dose- and time-dependent increased cytotoxic activity was detected for both substances. AGS cells were more susceptible to the cytotoxic effects of these substances than Caco cells. Then the cytotoxicity of the combinations containing different doses of each substance was reevaluated in order to assess the combination index (CI) and find out the combination that synergistically inhibits cell growth by using the SynergyFinder program. The apoptotic effects of WBP, 5FU, and their synergistic combination were investigated through various cellular and molecular techniques. Their preventive effects on cell migration were also tested by in vitro scratch assay.

All treatments induced apoptotic cell death and prevented migration of the cancer cells. Dual staining with a fluorescent dye pair (HO/PI) revealed that the number of apoptotic cells in both cell lines treated with the combination was significantly higher than in the single treatments. Expression levels of cell cycle and apoptotic marker proteins determined by the Western blotting method were significantly high after combined treatment in both cell lines. The 5FU+WBP combination also prevented the migration of both cells almost entirely.

These findings indicated that water-based propolis possesses anticancer activity on human gastric and colon cancer cell lines, and enhances the cytotoxicity of 5-fluorouracil [1].

Key Words: **Water-based propolis, 5-flurouracil (5-FU), gastric cancer, colon cancer, anticancer activity.**

Acknowledgements
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Reference

[1] Göksoy, M. A., 2023. Su Bazlı Propolisin Antikanser Aktivitesi (in Turkish), M.Sc. Thesis, Istanbul University, Faculty of Science, Istanbul. 79 pages.

Quality Assessment of Global Propolis Samples Using Chemical Profiling Through HPLC and GC-MS

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Abstract

Propolis is a sticky resin produced by honeybees. Bees use propolis to coat the inside surfaces of the hive to maintain a sterile environment. A Bees collect resin from various plant species as a source of propolis, leading to a chemical diversity. The composition of the propolis also changes as per the season, region, plant source and the time of collection. Propolis has been studied and used for its diverse therapeutic potential.

Pupose: Understanding the chemical diversity from the global propolis samples, and its impact on therapeutic potential.

Objetives: In the current research work we have screened the propolis samples from the different parts of the world such as Brazil, Nigeria, United Kingdom (UK) and the propolis available with Nature's laboratory (NL) using HPLC and GC-MS techniques. Results showed the chemical diversity among the samples. The chemical composition observed from the samples can be correlated with the existing literature which can help to identify the therapeutical potential for them.

Methods: HPLC and GC-MS techniques have been used to screen the global propolis samples.

Results: Brown propolis from Brazil, showed the presence of flavonoids and flavanol such as galangin, naringin and quercetin which has been found responsible antioxidant and antimicrobial potential. Nigerian propolis from the Ekiti state showed the presence of Caffeic acid phenethyl ester (CAPE) which has been reported for its anti-inflammatory ability. Propolis from Ibadan state of Nigeria showed the presence of naringenin and ferulic acid which is well known for its skin

antiaging characteristics. Propolis sample from UK showed the presence of an abundant number of flavonoids such as Pinocembrin, Galangin, Ferulic acid which have been reported for its significant antimicrobial activity. NL propolis samples also showed significant presence of important flavonoids and polyphenols. GC-Ms screening of Nigerian samples showed the presence betulin, dotriacontane, alphabisabolol, germanicol, heneicosane important chemical constituents which have been reported for diverse therpaeutic potential.

Conclusion: We have screened many samples from around the world and observed a range of phytochemicals with complex chemistry. We at Nature's laboratory are involved in developing the library of global propolis samples with their detail chemical profiles as quality control tool. Multiple-marker assessment strategy with chemometric analysis may be an appropriate approach for propolis quality assessment.

Key Words: **Propolis, HPLC, GC-MS, Flavonoids.**

References

[1] Kasote, D., Bankova, V. & Viljoen, A.M. Propolis: chemical diversity and challenges in quality control. Phytochemistry Review 21, 1887–1911, (2022). doi: 10.1007/s11101-022-09816-1.

[2] Naik RR, Shakya AK, Oriquat GA, Katekhaye Shankar, Paradkar Aanat, Fearnley Hugo, Fearnley James. Fatty Acid Analysis, Chemical Constituents, Biological Activity and Pesticide Residues Screening in Jordanian Propolis. Molecules 26, no. 16: 5076.1-12, (2021). https://doi.org/10.3390/molecules26165076.

[3] Katekhaye Shankar, Fearnley Hugo, Fearnley James, Paradkar Anant. Journal of Apicultural Research, Vol. 58, No. 4, 604–616, (2019). doi.org/10.1080/00218839.2019.1614273.

New Green Propolis Extract Formulations as Promising Candidates to Substitute Hydroalcoholic Extract

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Abstract

The choice of technologies for manufacturing various propolis dosage forms can selectively influence the propolis compounds and their associated biological activities. The most prevalent form of propolis extract is hydroethanolic. Nonetheless, there is a substantial demand for ethanol-free propolis formulations, including stable powder form. To address these requirements, it was prepared and characterized an inclusion complex between green propolis and hydroxypropyl-β-cyclodextrin (HP-β-CD)1. While this complex exhibited significant improvements in solubility, particularly for artepillin C (17-fold higher solubility), it revealed a limitation in terms of propolis recovery yield, which was notably lower compared to the conventional propolis extract1. In response to these challenges, we developed and investigated three novel propolis extract formulations, each assessed for its chemical composition, antioxidant, and antimicrobial properties: polar propolis fraction (PPF), soluble propolis dry extract (PSDE), and microencapsulated propolis extract (MPE)2. The application of diverse extraction technologies yielded variations in their physical characteristics, chemical profiles, and biological activities. PPF was predominantly composed of caffeic and p-Coumaric acids, whereas PSDE and MPE closely resembled the chemical profile of the original green propolis hydroalcoholic extract. MPE, a fine powder containing 40% propolis in gum Arabic, exhibited excellent water dispersibility and possessed milder flavor, taste, and color attributes when compared to PSDE. PSDE, a fine powder containing 80% propolis with maltodextrin as a carrier, demonstrated complete water solubility and found utility in liquid formulations, offering transparency despite a pronounced bitter taste. PPF, a purified mass containing substantial amounts of caffeic and p-Coumaric acids, displayed the highest levels of antioxidant and antimicrobial activity, warranting further investigation. PSDE and MPE retained antioxidant and antimicrobial properties. In particular, MPE demonstrated noteworthy antimicrobial, antioxidant, anti-inflammatory, antitumoral, and anti-hypercholesterolemic activities, along with a remarkable 100% increase in artepillin C permeation within the studied model3, being a promise candidate for diverse products applications.

Key Words: **Ethanol-Free Propolis Formulations, Propolis-Hydroxypropyl-B-Cyclodextrin Complex,**

Polar Propolis Fraction, Soluble Propolis Dry Extract, Microencapsulated Propolis Extract, Higher Solubility

References

[1] Rocha, B.A., Rodrigues, M.R., Bueno, P.C.P.B., Costa-Machado, A.R.M., Vaz, M.M.O.L.L., Nascimento, A.P., Barud, H.S., Berretta-Silva, A.A., 2012. Preparation and thermal characterization of inclusion complex of Brazilian green propolis and hydroxypropyl-ß-cyclodextrin – increased water solubility of the chemical constituents and antioxidant activity. Journal of Thermal Analysis and Calorimetry, 108:87-94. DOI 10.1007/s10973-011-1713-4.

[2] Berretta, A.A., Zamarrenho, L.G., Correa, J.A., De Lima, J.A., Borini, G.B., Ambrósio, S.R., Barud, H.S., Bastos, J.K., De Jong, D., 2023. Development and Characterization of New Green Propolis Extract Formulations as Promising Candidates to Substitute for Green Propolis Hydroalcoholic Extract. Molecules, 28(8):3510. https://doi.org/10.3390/molecules28083510.

[3] Berretta, A.A., De Lima, J.A., Falcão, S.I., Calhelha, R., Amorim, N.A., Gonçalves, I.S., Zamarrenho, L.G., Barud, H.S., Bastos, J.K., De Jong, D., Vilas-Boas, M., 2023. Development and Characterization of High-Absorption Microencapsulated Organic Propolis EPP-AF® Extract (i-CAPs). Molecules, 28, 7128. https://doi.org/10.3390/molecules28207128.

Medicinal Forms and Therapeutic Uses of Iranian Propolis

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Abstract

Propolis can be considered as a miracle among bee products. This product is highly dependent on the bee environment as well as its processing conditions. Due to the variety of herbal plants in Iran, Iranian propolis has different properties that increase its effectiveness. Biological research on Iranian propolis proved to us that it is better to prepare a therapeutic product with combination of different propolis. This thinking made the products that are used for therapeutic supplement to be much more effective and practical than the propolis of an area. Tablets, gels, creams, and mouthwashe prepared from different extracts of irainan propolis have been commercially produced for more than 10 years in Soren Tech Toos company. In order to ensure the safety and practicality of these products, a significant number of practical researches and clinical trial have been carried out during last 10 years, which have yielded valuable results.

The belief that propolis can be a suitable substitute for a number of expensive diseases tretment with the knowledge of proper quality and applicable formulation is expanding. The results of our researchs are being exploited in a practical way. In these researchs, diseases such as problems of mouth contamination and wounds resulting from radiotherapy of head and neck cancers, prevention of decay of orthodontic teeth, reduction and elimination of aphthous stomatitis, healing of various wounds and burns, as well as diabetic wounds. In these researchs, it has been shown that different types of cancer can be treated or help to better effectivines of other medicin with specific consumption of propolis tablets with the presented formulation.

Based on the research done, it can be said that a suitable propolis product should be given special attention to propolis qulaityand final applicable formulation.

Key Words: **Iranian Propolis, Propolis Tablet, Propolis Medicinal Products**

Propolis from Omani Plants

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Abstract

Commiphora wightii was popularly known to be present within tropical Africa and some Indian regions. The stem bark extract of the plant was investigated for phytochemical screening and In vitro anti-malarial bioassay using nhexane, chloroform, ethylacetate and methanol solvent fractions. The phytochemical screening revealed the presence of flavonoids, alkaloids, terpenoids, tannins, saponins anthraquinones and carbohydrates. The bioassay results showed that, nhexane fraction have the highest percentage of parasite elimination of 91.8% at 5000µg/ml lower than the standard antimalarial drug (artemesinin combine treatment) with 92.8% at 5000µg/ml concentrations. Thus, it can be concluded that, further research on the plant may lead to the discovery of new potential anti-malarial drug in near future.

From the first paper published about Omani propoils in 2013, Omani propolis: Chemical profiling, antibacterial activity and new propolis plant sources in the Chemistry Journal. The results were shown that Omani propolis is different form the known propolis types and demonstrates significant chemical diversity. Its most important plant source is the resin of Azadirachta indica (Neem), and as a result its typical components are C5-prenyl flavanones. Other plant sources have been identified, too, playing some role in resin collection by bees in Oman: Acacia spp. (most probably A. nilotica) “Sumr” and Mangifera indica mango tree. The results demonstrate also the potential of Omani propolis as antimicrobiall wish to make advance research about.

From above results obtained, another important plants were observed which is very important to the honey bee as (bee glue) this plant known as “Muqal” Commiphora wightii. The bee collects from this tree a lot of secretion especially in mountain like Rustaq and Al Hajer.
The aim of the study The future research would be conducted about this medical plant and the relation between Muqal and Propolis from those hives in the same location.

Key Words: **Muqal, Omani Propolis, Mukal, Guggul, Commiphora Wightii**

References

[1] P. Milena, D. Rosa, T. Hassan, T. Iva, N. Hristo, B.Vassya. Omani propolis: Chemical profiling, antibacterial activity and new propolis plant sources. Chemistry Journal. 2013. p. 158.

[2] Huang, Shuai; Zhang, Cui-Ping; Wang, Kai; Li, George Q.; Hu, Fu-Li ang Recent Advances in the Chemical Composition of Propolis. Molecules. 2014; 19(12):19610-19632. 2014.

[3] Propolis: Composition, Health, Medicine: A Review Stefan Bogdanov. Bee Product Science, www.bee-hexagon.net
[4] Phytochemical Screening and Anti-plasmodial Activity of Balsamodendron africanum (A. Rich) (Burseraceae) Abdurrahman Siraj Abubakar, Oumar Al-Mubarak Adoum, Yusuf Hassan, Bello Ibrahim. American Journal of Bioscience and Bioengineering. 2016; 4(6): 65-69

Importance of Botanical Source Identification for Propolis Standardization

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Abstract

There has been a growing interest in consumers' preferences for propolis containing products due to its wide range of pharmacological activities which are related to its main chemical components. This should be highlighted that propolis chemical composition is directly linked to its main botanical source. As an example, if honeybees obtain the resinous substance mainly from Populus nigra L. (black poplar), this propolis type can be called as "black poplar-type propolis" and its main chemical components are caffeic acid phenethyl ester (CAPE), chrysin, galangin, pinocembrin etc. whereas if propolis is botanically originated from Baccharis dracunculifolia DC., its active ingredient is characterized as Artepillin C. Therefore, botanical source identification of propolis linked to the main component(s) characterization can guide the propolis standardization studies. However, it is important to apply appropriate method(s) for botanical origin identification: Chromatographical technique or palynological analysis?

In Türkiye, most of the propolis samples collected from through the country is determined as "black poplar-type propolis" [1-3]. Up to now, several propolis containing products have been commercialized in this country. Lack of propolis botanical source identification is not only a quality problem for these products. Also, some companies that produce these products tend to commit fraud on labeling. These products contain either aqueous propolis extracts or alcoholic/hydroalcoholic extracts. However, it has been shown that only some phenolic acids as caffeic acid and ferulic acid can be extracted with water, not the main components as CAPE which is responsible for the various pharmacological activities of propolis. For this reason, some companies alkalize the water to extract the main components without indicating the agent used for pH increasement. These products may cause undesirable health problems, especially when used by children. Consequently, quality control analysis should be obligatory before marketing the propolis products.

Key Words: **Propolis, Botanical Origin, Standardization, Quality Control**

References

[1] Guzelmeric, E., Ristivojević, P., Trifković, J., Dastan, T., Yilmaz, et al. 2018. Authentication of Turkish propolis through HPTLC fingerprints combined with multivariate analysis and palynological data and their comparative antioxidant activity. Food Science and Technology-LWT, 87, 23-32. DOI: 10.1016/j.lwt.2017.08.060

[2] Guzelmeric, E., Yuksel, P.I., Yaman, B.K., Sipahi, H., Celik, C., et al. 2021. Comparison of antioxidant and anti-inflammatory activity profiles of various chemically characterized Turkish propolis sub-types: Which propolis type is a promising source for pharmaceutical product development? Journal of Pharmaceutical and Biomedical Analysis, 203 (11), 114196. DOI: 10.1016/j.jpba.2021.114196.

[3] Guzelmeric, E., Sipahi, H., Özhan, Y., Hamitoğlu, M., Helvacıoğlu, S., et al. 2023. Comprehensive estrogenic/anti-estrogenic, anticancer, mutagenic/anti-mutagenic, and genotoxic/anti-genotoxic activity studies on chemically characterized black poplar and Eurasian aspen propolis types. Journal of Pharmaceutical and Biomedical Analysis, 226, 115241. DOI: 10.1016/j.jpba.2023.115241.

Influence of Shading Hives on Green Propolis Production and Quality in the Northeastern Brazilian Caatinga

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Abstract

Introduction: Propolis is a substance produced by honey bees (Apis mellifera) from plant parts and resins, which they use for colony defense against pathogens, intruders, and to regulate hive temperature and humidity. Caatinga green propolis, that bees make from the buds of Mimosa tenuiflora, a tree with dark bark, locally known as jurema-preta (black jurema), is produced in the northeastern Brazilian Caatinga region. Protecting beehives with simple dried-palm-leaf shading structures can help reduce heat stress in these hot, semi-arid areas. This study assessed the impact of varying thermal conditions in shaded and unshaded apiaries on the production and quality of propolis in honey bee colonies. Methodology: The research involved Africanized honey bee colonies maintained either in direct sunlight or under shade in a hot arid region in the state of Rio Grande do Norte, Brazil. Monitoring within the hives included temperature and humidity measurements. Propolis was extracted in ethanol in a Soxhlet apparatus, and evaluations were made of total phenolics and flavonoids. Propolis production was also recorded. Results: Propolis collected from shaded hives had significantly higher percentages of total phenolics (12.71 ± 0.7) and flavonoids (9.713 ± 0.7) compared to those from sun-exposed hives (10.13 ± 0.6 and 6.618 ± 0.9, respectively). Additionally, propolis production was significantly greater in shaded hives. Colonies that were shaded maintained significantly higher humidity and lower temperatures than their sun-exposed counterparts. Conclusions: Shading significantly improved thermal comfort for bees and promoted increased production. As a result, hives maintained under shade yielded more propolis of higher quality.

Key Words: **Caatinga Green Propolis, Mimosa Tenuiflora, Thermal Conditions, Honeybee Colonies, Flavonoids, Phenolic Compounds.**

Chemical Composition of Honey and Propolis From the Stingless Bee Scaptotrigona Mexicana

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Abstract

The chemical composition of stingless bee honey and propolis is influenced by the plant varieties surrounding the bee colonies, the preferences of the bee species, and the local climate conditions. Our research focused on examining the composition of honey and propolis produced by the Scaptotrigona mexicana stingless bee species to understand the varying impact of these factors. Samples collected from 24 colonies, with 12 each from two S. mexicana meliponaries situated approximately 8.5 km apart in the state of Chiapas, southern Mexico: Tuxtla Chico and Cacahoatán were analysed. To investigate the chemical composition of honey, nuclear magnetic resonance (NMR) was used, while gas chromatography-mass spectrometry (GC-MS) was used to study propolis. Chemometric analyses was further employed. The antioxidant activity of propolis was also assessed. The results showed that the honey samples from Tuxtla Chico are characterised by higher levels of glucose and fructose, while those from Cacahoatán exhibited a diverse composition of di- and trisaccharides; the differences can be attributed to the distinct nectar sources preferred by the bees in each location. Furthermore, the composition of propolis from these two locations revealed qualitative differences, indicating that the bees selectively chose resins. The significant variations observed in the chemical composition of S. mexicana propolis and honey from two relatively close locations support the assumption that bee species alone may not be the predominant factor influencing their chemistry.

Key Words: **stingless bee, Scaptotigona mexicana, honey, propolis, chemical composition.**

Acknowledgements

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Investigation of The Effect of Propolis Extraction Conditions on Bioactive Components

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Abstract

Propolis is a resinous substance collected by honeybees from various plant sources. It is used by bees to seal and protect their hives from external threats such as bacteria, fungi, and parasites. Propolis contains a wide range of bioactive compounds, including polyphenols, flavonoids, terpenes, and phenolic acids, which contribute to its therapeutic properties. Propolis extraction plays a crucial role in making this natural product suitable for human consumption. However, the diverse composition of propolis poses challenges in terms of consumption and standardization. By conducting comparative studies using various solvents and extraction conditions, researchers can chemically characterize propolis and determine its biological activity. In this study, the main objective is to investigate the impact of various solvents and extraction conditions on the biological activity of propolis extracts. Ethanol, monopropilen glikol and glycerol extracts of propolis will be prepared. The extraction will be performed at 50 and 60 °C as 24 hours. Total phenolic contents were also measured colorimetric total phenolics assay that utilizes Folin-Ciocalteu reagent. The antioxidant capacity of propolis extracts will be assessed using two well-established assays: the 1, 1-diphenyl-2-picrylhydrazyl radical (DPPH) assay and the ferric reducing antioxidant power (FRAP) assay. The present study is expected to serve as a valuable resource in uncovering the impact of novel solvent combinations, diverse extraction conditions, and the commercialization potential of propolis within our country. As scientific research on bee products continues to grow steadily, this study aims to contribute to the expanding body of knowledge in the field. By exploring the effects of different solvents and extraction conditions on propolis, it will provide valuable insights and practical guidance for future research endeavors.

Key Words: **Propolis, extraction, solvent type, total phenolic content, antioxidant, flavonoid**

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A Study on Shelf Life of Propolis Extracts Based on Bioactive Properties

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Abstract

As awareness of the relationship between food and health has grown in recent years, bee products have become increasingly popular. The extraction process is the key step to extract a variety of health-promoting compounds. The extraction temperature-time and solvent composition have a significant effect on the bioactive properties of the final product. It is also essential to reveal changes in the bioactive properties of propolis extract during its shelf life. The shelf life of three different solvent extracts (i.e. ethanol, monopropilen glikol, and glycerol) were studied. The extraction was performed at 50 and 60 °C as 24 hours. Following extraction process, the extracts were stored at +4 °C for 1 years. Total phenolic content (TPC), ferric reducing antioxidant power (FRAP), and flavonoid content of the extracts were measured after one year of the shelf life period. Those results were compared with the bioactive properties measured just after the extraction process. It is believed that the identification of these changes will provide a foundation for studies on the determination of the shelf life of the product and will contribute to the investigation of product stability at a commercial level.

Key Words: **Propolis, shelf life, antioxidant, total phenolic content, flavonoid, stability**

Determination of Wax Content of Olive Oil-Propolis Extracts Prepared Under Different Conditions

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Abstract

Propolis is a resinous bee product collected by honey bees from different parts of plants. Due to its different functional properties, this product has been used for centuries as a traditional medicine in the prevention/treatment of many diseases all over the world. Despite its unique functional properties attributed in the literature, propolis is not suitable for use in its raw form, harvested directly from the hive, but is a natural product extracted in appropriate solvents and offered for consumption. Therefore, the extraction method to be applied to propolis and the choice of solvent to be used in extraction are very important. In this study, propolis extracts were prepared using different extraction methods (maceration, ultrasonic-assisted and ohmic heating-assisted) and extraction conditions (temperature, time, solid-solvent ratio, etc.) using olive oil, which has been frequently preferred as a solvent in propolis extraction in recent years. Firstly, some quality parameters of the extra virgin olive oil used in the study were specified. Then, the extraction was performed according to the Box-Behnken experimental design for different extraction methods. In this context, it was determined that the extra virgin olive oil was suitable for the quality criteria reported in the Turkish Food Codex in terms of myristic acid, palmitic acid, palmitoleic acid, margaric acid, margoleic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, arashidic acid, gadoleic acid, behenic acid and lignoceric acid. In addition, the wax content of the extracts prepared using different extraction methods and conditions

was determined. The results showed that extraction method and conditions affect the amount of wax removed from propolis.

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Comparative Flavonoid Profiling of Middle Eastren, African, and European Propolis Samples and Its Correlation with Their Therapeutic Potential

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Abstract

Propolis, the golden gift of bees, is a natural treasure that has been cherished for centuries. This ancient healer, derived from the heart of beehives, is known for its ability to fight infections, boost immunity, quench the free radicals, and many more. The composition of propolis differs globally, leading to a wide range of chemical profiles harvested from various parts of the world [1]. The therapeutic potential of propolis samples from various parts of the world such as, Middle Eastern (Türkiye, Palestine & Jordan), African (Libya, Morocco & Nigeria), and European (Finland & Portugal) regions can be linked to their specific chemical compositions, including the presence of flavonoid and other bioactive compounds. In the present study, we have compared the flavonoid profiles of eight propolis samples from Middle Eastern, African, and European regions by using reverse-phase High-Performance Liquid Chromatography [2]. Cinnamic acid was found in all the samples analyzed. Naringenin and pinocembrin were also present in all samples except from Finland and Turkish propolis respectively. Major constituents observed in propolis sample from Finland were caffeic acid and quercetin. African and Middle Eastern propolis showed naringenin up to 2.8 mg/g. In addition to that, Middle Eastern propolis also showed substantial amounts of caffeic acid and chlorogenic acid. Significant amounts of chrysin were found in European propolis. The flavonoid profile of propolis varies due to its geographic origin, climate, plant sources, and the bee species responsible for its production. These factors collectively contribute to the unique chemical composition of propolis from different regions [3-4]. These variations in chemical composition contribute to the distinct therapeutic potential of propolis from different regions such as presence of caffeic acid, chrysin, naringenin and pinocembrin are known for their antimicrobial, antioxidant, and anti-inflammatory properties. These medicinal properties of flavonoids can be correlated with health benefits of propolis, making it a valuable natural remedy with a wide range of medicinal properties.

Key Words: **Flavonoid profiling, Middle Eastern, African, European propolis, HPLC, antioxidants**

References

[1] Bankova, V., 2009. Chemical diversity of propolis makes it a valuable source of new biologically active compounds. Journal of ApiProduct and ApiMedical Science, 1(2), 23–28. https://doi.org/10.3896/ibra.4.01.2.01

[2] Touzani, S., Imtara, H., Katekhaye, S., Mechchate, H., Ouassou, H., Alqahtani, A. S., Noman, O. M., Nasr, F. A., Fearnley, H., Fearnley, J., Paradkar, A., Elarabi, I., & Lyoussi, B., 2021. Determination of phenolic compounds in various propolis samples collected from an african and an asian region and their impact on antioxidant and antibacterial activities. Molecules, 26(15). https://doi.org/10.3390/molecules26154589

[3] Zhou, J., Li, Y., Zhao, J., Xue, X., Wu, L., & Chen, F. (2008). Geographical traceability of propolis by high-performance liquid-chromatography fingerprints. Food Chemistry, 108(2), 749–759. https://doi.org/10.1016/j.foodchem.2007.11.009

[4] Bruschi, M. L., Franco, S. L., & Gremião, M. P. D., 2003. Application of an HPLC method for analysis of propolis extract. Journal of Liquid Chromatography and Related Technologies, 26(14), 2399–2409. https://doi.org/10.1081/JLC-120023254

Propolis Mechanisms and Effects in Depression and Anxiety, from Literature to Practice

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Abstract

Introduction. Propolis is a resinous substance collected by bees from different plants that is widely used in health care and pharmaceutical products.

Composition and actions. Propolis contains more than 200 natural constituents - including polyphenols, phenolic aldehydes, sequiterpene-quinones, coumarins, amino acids, fatty acids, steroids and inorganic compounds - and has antimicrobial, antioxidant, anti-inflammatory and neuroprotective activities.

Depression and anxiety. Propolis oil has an anxiolytic effect by antagonizing the hyperfunction of the hypothalamic-pituitary-adrenal axis and antidepressant. Chrysin, a flavonoid found in propolis, is found to have antidepressant effects in chronic stress. Propolis also has antioxidant effects in the brain tissue. In addition, propois can modulate stress and anxiety, by reducing the glucocorticoid hormones and cortisol.

Keywords: **propolis, depression, anxiety, stress**

Bisphenol A Risk in Propolis

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Abstract

Propolis is a bee product produced from plant resins collected by honey bees. In general, its natural structure contains 50% resin and herbal balsam, 30% beeswax, 10% essential and aromatic oils, 10% pollen and other organic substances. Antibacterial, antiviral, antioxidant, anti-inflammatory, immunomodulatory, immunostimulating, hepatoprotective, cytotoxic, etc. It has been proven to have many beneficial pharmacological properties such as: Propolis is obtained from hives in two ways; by scraping or using plastic traps. It is thought that propolis may be contaminated with bisphenol A from plastic traps in regions where beekeeping is carried out at high temperatures. Bisphenol A is a chemical that is an endocrine disruptor and is banned in many countries, especially through food, due to contamination of some chemicals found directly in foods or in their packaging. In this preliminary study, a total of 20 propolis traps in two different colors, purchased from a company selling bee products, were analyzed for BPA content. 0.06 ppm BPA was detected in the analyzed green propolis traps. This study emphasizes the importance of performing BPA analysis in propolis used for health purposes and obtained using plastic traps.

Key words: **Propolis, Bisfenol A, Plastic Trap**

1. Introduction

Honeybees use it for purposes such as plastering the hive walls to prevent the development of microorganisms in the hive, covering the breaks and cracks in the hive, keeping the humidity and temperature constant in the hive, mummifying dead insects and animals that die inside the hive and are too large to be carried out of the hive to prevent them from stinking, and making the hive entrance hole smaller. They use propolis. Coating the comb cells with a thin layer of propolis is to protect the fry (larvae and pupae) from infections. Thus, they provide an antibacterial, antifungal and antiviral environment in the hive (Silici, 2021).

The color of propolis varies from green, red, yellow, and brown depending on the plant source, time of collection, and storage time. Its smell is unique and characteristic. Its taste is intensely aromatic and astringent in its raw form. In general, its natural structure contains 50% resin and herbal balsam, 30% beeswax, 10% essential and aromatic oils, 10% pollen and other organic substances. Propolis is a

heterogeneous mixture consisting of honey bees' saliva, beeswax, and plant sap and bud resins.

Contamination of propolis with wax, wood chips, paint, bee parts and other debris should be avoided and macroscopic cleaning should be done first. Propolis collection traps placed on the top of the hives are ideal for clean production, harvest can be faster and in greater quantity. However, the fact that plastic traps contain bisphenol A is a significant risk.

Foodborne endocrine disruptors are molecules that are naturally present in foods taken into the human body through consumed foods, occur during food processing, are transmitted to foods through contact due to additives added to foods, and are found in foods through contamination from the environment where the foods are obtained. Some of the endocrine disruptors that we are exposed to, especially through foods, due to contamination of some chemicals found directly in foods or in their packaging, are as follows: Bisphenol A, dioxins, pesticides, perchlorobiphenyls, phthalates. There are many scientific studies on the negative effects of Bisphenol A. For example, in a study conducted in sheep, it was shown that low doses of Bisphenol A (BPA) changed the fetal ovarian steroidogenic gene, gonadal differentiation and folliculogenesis (Rivera et al., 2011; Veiga-Lopez et al. 2013). BPA also impaired miosis in animals (Hunt et al., 2012). In addition to in vivo studies, in vitro studies have shown that BPA (at a dose of 1-30 micromolar) disrupts meiotic progression and induces epigenetic changes in cultured cells created from human fetal oocytes (Brieno-Enriquez et al., 2011; 2012; Trapphoff et al., 2013).

2. Material and Method

20 plastic traps (10 white, 10 green) were purchased from a shop selling beekeeping supplies in Izmir. Traps were analyzed for BPA according to TS EN 14372 (2004).

3. Results and Discussion

0.06 ppm Bisphenol A was detected in 10 green colored traps. This level is below the limit value (maximum 0.6 ppm) according to TGK Communiqué on plastic materials and materials in contact with food 2019/44. However, it is thought that the amount of Bisphenol A may increase with the increase in temperature and contamination of this chemical in propolis may pose health risks. As a matter of fact, specific regulations and bisphenol A bans in different countries around the world are given in Table 1.

Table 1. Specific regulations regarding endocrine disruptor BPA (United Nations Environment Programme, 2017).

Country	BPA	Specific regulation
Avrupa Birliği	4,4'-izopropilidendifenol; (**Bisfenol A**); CAS No. 80-05-7	Restricting the use of polycarbonate baby bottles; Limiting the migration limit in plastic materials intended to come into contact with food to 0.6 mg substance/kg. The use of epoxide in the coating of food packaging for children aged 0 to 3 and in water pipes at home is prohibited.
Fransa	**Bisfenol A**	Its use is prohibited on all materials that come into contact with food.
İsveç	**Bisfenol A**	The use of epoxide in the coating of food packaging for children aged 0 to 3 and in water pipes at home is prohibited.
Belçika	**Bisfenol A**	It is prohibited for use in materials intended to come into contact with food, designed for children aged 0 to 3 years
Danimarka	**Bisfenol A**	It is prohibited for use in materials intended to come into contact with food, designed for children aged 0 to 3 years.

It is important to perform residue analyzes on propolis to be used for health purposes. It is also important that it does not contain bisphenol A, an endocrine disruptor. Contamination may be related to the quality of the traps used to collect propolis. For this reason, we recommend BPA analysis if propolis collected with a plastic trap is to be used for health purposes.

References

[1] Brieno-Enriquez, M. A., Robles, P., Camats-Tarruella, N., Garcia-Cruz, R., Roig, I., Cabero, L., ... & Caldés, M. G. (2011). Human meiotic progression and recombination are affected by Bisphenol A exposure during in vitro human oocyte development. Human reproduction, 26(10), 2807-2818.

[2] Hunt, P. A., Lawson, C., Gieske, M., Murdoch, B., Smith, H., Marre, A., ... & VandeVoort, C. A. (2012). Bisphenol A alters early oogenesis and follicle formation in the fetal ovary of the rhesus monkey. Proceedings of the National Academy of Sciences, 109(43), 17525-17530.

[3] Rivera, O. E., Varayoud, J., Rodríguez, H. A., Muñoz-de-Toro, M., & Luque, E. H. (2011). Neonatal exposure to bisphenol A or diethylstilbestrol alters the ovarian follicular dynamics in the lamb. Reproductive Toxicology, 32(3), 304-312.

[4] Silici, S. (2020). Bilimsel Gerçeklerle Apiterapi. Akademisyen Kitapevi. Ankara.

[5] Trapphoff, T., Heiligentag, M., El Hajj, N., Haaf, T., & Eichenlaub-Ritter, U. (2013). Chronic exposure to a low concentration of bisphenol A during follicle culture affects the epigenetic status of germinal vesicles and metaphase II oocytes. Fertility and sterility, 100(6), 1758-1767.

[6] Veiga-Lopez, A., Luense, L. J., Christenson, L. K., & Padmanabhan, V. (2013). Developmental programming: gestational bisphenol-A treatment alters trajectory of fetal ovarian gene expression. Endocrinology, 154(5), 1873-1884.

The Development of Topical Products from Indonesian Stingless Bee Propolis: Therapeutic and Cosmetic Applications

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Abstract

The field of meliponiculture, which focuses on the breeding and management of stingless bees, is significantly less advanced than apiculture. Nonetheless, there has been a marked resurgence in interest in meliponiculture particularly in Indonesia. This renewed attention has brought significant economic benefits to the rural areas. Therefore, developing a wider range of products based on stingless bee propolis could further benefit the Indonesian small-scale beekeeping communities. In addition, the development of topical products derived from propolis has lagged behind those consumed orally or taken as supplements. Propolis extracts from Indonesian stingless bees possess antioxidant and anti-inflammatory properties, making it an excellent candidate for therapeutic topical applications as well as to be incorporated into skincare and cosmetic products. We investigated the hydro-glyceric extract of propolis harvested from the nests of the Indonesian native Geniotrigona thoracica. It was found to contain various phytochemical compounds, including polyphenols, terpenoids, saponins, alkaloids, vitamins, and minerals. This presentation explores the potential use of the hydro-glyceric extract from Indonesian stingless bee propolis. Through several case studies, we will examine its application in topical formulations designed to treat various skin conditions in humans and its potential uses in veterinary medicine.

Key Words: **Stingless Bee, Propolis, Topical Application, Therapeutic, Cosmetic, Wound Healing**

Propolis Promotes Social Homeostasis in Honey Bees and Supports Mite Resistant Behaviors

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Abstract

Honey bees are constantly dealing with threats from pathogens, pests, pesticides and poor nutrition. It is critically important to understand how honey bees' natural immune responses (individual immunity) and collective behavioral defenses (social immunity), can improve bee health. One form of social immunity in honey bee colonies is the formation of a propolis envelope, made up of bee-collected plant resins, within the nest that acts as an important antimicrobial layer. Previous research has indicated that honey bees (Apis mellifera) use these resins as indirect and direct defenses against various microorganisms. Further, a resin-rich environment effects individual physiological immune responses and resin foraging behavior can be influenced by pathogen exposure. In addition, new studies examining the effect of a propolis enriched environment on Varroa mite population growth in colonies varying in their behavioral resistance to the mite has shown the role that propolis can also play in reducing colony mite infestations. Overall, from several years of study, there is building evidence that honey bees' use of resin in their nest architecture as propolis supports social homeostasis, colony health and productivity.

Key Words: **Apis mellifera, social immunity, honey bee health, Varroa destructor**

Propolis International Standard Proposed by ISO

– A Vital Regulatory Framework for Ensuring Authenticity and Quality in The Global Propolis Market

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Abstract

Propolis is a resinous substance created by bees to protect their hives. Bees gather bioactive exudates and plant resins to make propolis. As a result, due to the variety of plant species across different regions worldwide, propolis exhibits a wide range of organoleptic, chemical and biological properties. The primary commercialized types of propolis are brown (Populus spp.), produced in Europe and Asia, followed by green (Baccharis dracunculifolia), exclusively from Brazil, and red from Dalbergia and Clusia spp., produced in Central and South America. The global supply of propolis is currently estimated at 700-800 tons/year, with an estimated market value of US$ 700 million annually, projected to reach US$ 829 million by 20271. However, a significant challenge in this market has been the lack of standardization among companies that commercialize propolis, coupled with a lack of regulations in many countries. There is an urgent need for internationally validated and standardized methodologies, as well as the establishment of authenticity and quality requirements. In this context, the ISO/NP 24381 project, initiated in 2019 by ISO, represents a vital regulatory framework. The project was collaboratively developed by experts from 17 countries. It specifies quality requirements, analytical methods, guidelines for packaging, marking, labeling, and recommendations for storage and transportation conditions for propolis produced by Apis mellifera bees. The proposed methodologies underwent inter-laboratory validation involving 14 laboratories worldwide, including Belgium, Brazil, China, Germany, Italy, France, Portugal, Romania, Spain, and Türkiye. Seven samples, including five brown, one green, and one red propolis, were assessed. Eight key analytical parameters were determined as part of this standard: ethanol extractables determination, total ash and petroleum ether content, loss on drying, total phenolics and flavonoids, phenolic profile, and antioxidant capacity. This document will probably be the first regulatory framework published around the world to establish authenticity and quality requirements for propolis.

Key Words: Propolis, Specification, Standard, Authenticity, Quality, ISO

References

[1] Oliveira, F.I.S., Oki, Y., Resende, F.M., Angrisano, P., Arantes-Garcia, L., 2021. From Innovation to Market: An Analysis of the Propolis Production Chain. In: Baccharis: From Evolutionary and Ecological Aspects to Social Uses and Medicinal Applications. Springer International Publishing, Switzerland, pp. 547-564.

Films and Coating Innovation: Harnessing the Power of Propolis

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Abstract

Propolis is recognized for its richness in bioactive compounds such as polyphenols, flavonoids, and terpenes, which give it notable antimicrobial, antioxidant, and anti-inflammatory properties. The incorporation of propolis into films and coatings has emerged as a captivating area of research and development, exploring the ability to deliver the bioactive substances into different environments, control the releasing dynamics or undercover undesirable properties. These opportunities make it a valuable candidate for a large number of applications, ranging from food packaging to human or animal health. In the food industry, propolis-infused films and coatings have demonstrated the ability to extend shelf life by inhibiting microbial growth and oxidative deterioration. Similarly, in the medical field, propolis-based coatings are explored for their potential to reduce infections and promote tissue regeneration.

This presentation will review recent advancements in the incorporation of propolis into film and coating formulations, focusing on its impact on material properties, durability, and sustainability. Furthermore, it will highlight the potential fields of application and challenges associated with incorporating propolis, such as colour and odour issues. The combination of propolis in films and coatings aligns with the growing demand for natural and eco-friendly solutions, presenting exciting opportunities to create functional materials that benefit diverse industries while harnessing the power of nature.

Key Words: **Propolis bioactivity, biopolymers, polysaccharides, phenolic compounds, food packing, wound healing**

Amount of Individual Phenolic Compounds in Commercial Propolis Products, Quality and Standardization

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Abstract

The aim of this study was to evaluate concentrations of individual phenolic compounds which have useful biological effects in commercial propolis products, and to evaluate determined results for quality and standardization of propolis products.

Anayzed propolis samples (n=243) were commercial raw propolis and products from India, Brazil, China, France, South Korea, USA, Canada and different provinces of Türkiye and they were selling in Türkiye and India between 2015 and 2022 in published and unpublished data.

Caffeic acid, CAPE, gallic acid, ferulic acid, p-coumaric acid, cinnamic acid, chalcone, pinocembrin, kaempferol, naringenin, galangin, chrysin and quercetin were determined by HPLC-DAD system. The concentrations of individual phenolics were highly variable. Significant differences were observed for the analyzed phenolic compounds between local and imported samples, for both raw and ethanol-based propolis products, as well as for those based on water and ethanol. Therefore, biological, and pharmacological activities of the commercial propolis samples would be change according to using propolis products for apitherapy, human consumption and scientific research.

The main reason for these differences among the propolis products should be related to origin of propolis, extraction solvent, the volume of extraction solvent, the amount of propolis used, extraction time, equipment used, and the extraction temperature.

Studies of biological and pharmacological activities of propolis have to be performed only with chemically characterized and standardized propolis to get meaningful, reliable, and reproducible results. In this context, the identification and quantitative determination of some individual phenolics that have beneficial effects and are widely found in propolis might be useful for the determination of the quality of propolis- and propolis-based products for efficacy. International rules should develop to guarantee for minimum individual phenolic compounds which have useful biological effects and their concentrations. There are recently some studies for certified system of quality control for raw propolis and propolis-based products in Türkiye and ISO.

Key words: **Propolis, Commercial Products, Individual Phenolics, Quality, Standardization**

The Main Factors Affecting the Quality of Honey Bees' Life and Products

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Abstract

Honey bees are of the greatest significance in the pollination process of various plants including agricultural products. Aside from their pollinator roles, they are tremendous suppliers of nutrients that contribute to human health, such as honey, pollen, propolis, royal jelly, etc.

Honey bee products have been widely used in traditional medicine since ancient times, and they continue to be the focus of attention in the sectors of food, cosmetics, and pharmaceuticals, thanks to their wide range of bioactive components. Hence, research on natural bee products has also expanded in response to rising consumer demand for diets that are more nutritionally sound, protective, and risk-free over the last ten years.

While the number of honey bee colonies is expected to increase as a consequence of economic interest in honey bee products there has been a significant decrease in colony numbers in a wide variety of countries around the globe in recent years. Moreover, these losses may risk the presence and welfare of human beings and other living things on Earth in the long term.

There are various factors that threaten the lives of honey bees and the quality of their products. These factors, alone or in combination, may contribute to honey bee colony losses as well as low quantity and poor quality of honey bee products.

Our research team aims to investigate the extent to which the honey bee hive is subjected to inside as well as outside stresses, with the aim of elucidating the impact of environmental circumstances and colony health on the safety and quality of honey bee products. Many aspects that affect honey bee colony survival, productivity, and overall product quality will be displayed in this presentation.

Key Words: **Stressors, Global Warming, Pollution, Chemicals, Bee Product**

Acknowledgments

This study was funded by the Scientific Research Projects Coordination Unit of İstanbul University, Türkiye (Project number: 34040), and the Council of Higher Education (YOK) 100/2000 CoHE PhD Scholarship.

Chemopreventive and Chemotherapeutic Effect of Propolis on Cancer

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Abstract

Propolis, a natural substance produced by honeybees (Apis mellifera L.), has been widely used for therapeutic abilities such as antioxidant anti-inflammatory and antimicrobial in Traditional Medicine. Although the composition of propolis is closely related to its botanical origin, processing, and environmental conditions, it contains many types of bioactive compounds. Many studies have shown that the phenolic and flavonoid components of propolis are mainly responsible for their biological activities. Numerous in vitro and in vivo studies have shown that different types of propolis and their phenolic compounds can also be used in the prevention and treatment of cancer. Because the hydroxyl groups of phenolic compounds can neutralize free radicals by donating electrons, they show a dose-dependent reactive oxygen species (ROS) generating effect in the presence of transition metals such as free iron and copper due to the Fenton reaction. For this reason, low doses of phenolic compounds contained in propolis can be used as chemopreventive and adjuvant in cancer with their antioxidant effects, while high doses can be used as chemotherapeutic agents with their pro-oxidant effects. Herein, the mechanism of those effects of propolis will be discussed in the light of the studies carried out by our group.

Key Words: **Propolis, Phenolic Compounds, Cancer, Chemoprevention, Chemotherapeutic Effect.**

Evaluation of the Biochemical Parameters and Histological Study of The Antidiabetic Effect of Propolis “In Vivo Study In Wistar Rats”

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Abstract

Diabetes is a disease characterized by chronic hyperglycemia. Traditional medicine offers alternative remedies such as natural products, which today represent an indispensable source for the discovery of new therapeutic molecules, presented for their preventive or curative properties towards various pathologies. In this context, we are interested in the study of propolis extract.

The aim of this study is to evaluate the antidiabetic effect of propolis. Diabetes was induced by a single intraperitoneal injection (IP) of streptozotocin (STZ) at 60 mg/kg for all experimental groups except the control group. One week after, 3 groups of rats were treated with two doses of propolis (150 mg/kg and 300 mg/kg) and glibenclamide at 5mg/kg by intragastric gavage for 21 days.

Biological parameters were studied throughout the experiment, including body weight, water consumption, and blood glucose levels as well as biochemical parameters as transferases enzymes (TGO, TGP), were measured. Histological parameters were also studied after sacrifice. After diabetes induction, a remarkable increase in blood glucose levels was observed in all diabetic rats compared to control rats. However, an improvement in blood glucose levels was observed during and after treatment in diabetic rats treated with propolis at compared to diabetic rats.

The studied biochemical parameters (TGO, TGP) also revealed significant differences between diabetic rats and control.These observations were confirmed by the histological examination of pancreatic tissue in diabetic rats treated with propolis, revealing almost the same microscopic appearance as in control rats. Conversely, diabetic rats demonstrated an irregular aspect with a reduction in the size and number of Langerhans islets. Histological examination of liver tissue showed a similar aspect in all diabetic rats treated with normal hepatocytes and hepatic sinusoids in absence of portal or periportal leukocyte infiltration.

The histology of renal tissue in all experimental groups showed normal renal parenchyma. This research shows that the propolis extract presents antidiabetic activity under the conditions of the present study.

Key Words: **Propolis, Streptozotocin, Diabetes, Blood Glucose, Rats, Histological Study.**

Acknowledgements
We are grateful to Balparmak for the complimentary support of water-based propolis and other honey bee products, and quality tests of the materials.

Water-Based Propolis Prevents Protein Oxidation in Fission Yeast Grown At High Glucose Concentration

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Abstract

Diabetes mellitus is one of the major health problems worldwide. The clinical indicator of diabetes is high levels of blood glucose (hyperglycemia), leading to increased production of reactive oxygen species (ROS) [1]. Cellular proteins get damaged as a result of excess oxidative stress, and insufficient antioxidant defense and/or repair processes. Protein carbonyls and advanced glycation end products (AGEs) are the most abundant protein damages accumulated in the cells thereby causing diabetic complications [2].

Propolis is suggested to possess antioxidant and antidiabetic properties because of its high phenolic content, mainly caffeic acid phenethyl ester (CAPE) [3, 4]. Although preclinical and clinical studies have been conducted related to the preventive and treatment effects of various propolis extracts in diabetes mellitus previously [5], reports on water-based propolis are very limited. This is the first report on its preventive effect against protein damage.

This study aimed to investigate the effects of water-based propolis (WBP) and CAPE on protein damage in fission yeast (Schizosaccharomyces pombe, a eukaryotic model organism), grown in a growth medium containing high levels of glucose miming hyperglycemic conditions. Protein carbonyls and AGEs in S. pombe cells treated with different concentrations of WBP and CAPE under experimental conditions were detected by Western blotting following the extraction and electrophoretic separation of cellular proteins. Water-based propolis and CAPE significantly and dose-dependently reduced ROS generation as well as protein carbonylation and glycation caused by high glucose concentration in S. pombe cells.

Overall results demonstrate that one of the modes of action of WBP is reducing oxidative stress and preventing protein damage, which is closely related to diabetic complications, as well as the pathogenesis of many other metabolic disorders. In addition, the ability of WBP to prevent protein oxidation seems not to be due solely to CAPE but also to its other constituents.

Key Words: **Water-Based Propolis, CAPE, Protein Oxidation, AGEs, Protein Carbonyls, ROS**

Acknowledgements
We are grateful to Balparmak for providing water-based propolis. This study was funded by the Scientific Research Projects Coordination Unit of Istanbul University, Project number: FLO-2021-37210. It was also supported by TÜBİTAK 2209-A - University Students Research Projects Support Program.

References

[1] Cole, J. B., and Florez, J. C., 2020. Genetics of diabetes and diabetes complications. Nature Reviews Nephrology, 16(7), 377-390. doi:10.1038/s41581-020-0278-5
[2] Papachristoforou, E., Lambadiari, V., Maratou, E., and Makrilakis, K., 2020. Association of glycemic indices (hyperglycemia, glucose variability, and hypoglycemia) with oxidative stress and diabetic complications. Journal of Diabetes Research, 2020, 1-17. doi:10.1155/2020/7489795
[3] Zhao, L., Pu, L., Wei, J., Li, J., Wu, J., Xin, Z., Gao, W., Guo, C., 2016. Brazilian green propolis improves antioxidant function in patients with type 2 diabetes mellitus. International Journal of Environmental Research and Public Health, 13(5), 498. doi:10.3390/ijerph13050498
[4] Göçer, H., and Gülçin, İ., 2011. Caffeic acid phenethyl ester (CAPE): Correlation of structure and antioxidant properties. International Journal of Food Sciences and Nutrition, 62(8), 821-825. doi:10.3109/09637486.2011.585963
[5] Balica, G., Vostinaru, O., Stefanescu, C., Mogosan, C., Iaru, I., Cristina, A., Pop, C.E., 2021. Potential role of propolis in the prevention and treatment of metabolic diseases. Plants (Basel), 10(5):883. doi: 10.3390/plants10050883.

Antiviral Activity of Propolis Against SARS-Cov-2 Infection in Real-Time In Vitro Cell Studies.

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Abstract

Significant data has established the potential of natural products and essential oils in mitigating the infection caused by COVID-19. Hence, the objective of this study was to formulate an oral/throat spray for preventive usage in the oral cavity or as an adjunct to therapeutic methods. Several essential oils, a cold-pressed oil, and propolis were chosen based on a reference survey. The antiviral effectiveness of samples was investigated using a real-time cell analysis procedure employing the xCELLigence RTCA MP instrument (Agilent et al., USA). The experiment involved the analysis of the cytopathic effect (CPE) induced by the virus and monitoring infection development inside the impacted cells. Vero E6 cells were used to test each component's cytotoxicity, antiviral activity, and the developed spray formulation against the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection. The formulation's mutagenicity, anti-mutagenicity, anti-inflammatory, antibacterial, and analgesic properties were examined. Phenolic compounds were detected in the propolis extract and the oral/throat spray. When diluted at a ratio of 1:640, the spray solution exhibited the greatest effectiveness in postponing the cytopathic effect for 54 hours. Additionally, the antiviral activity rate at this dilution was found to be 85.3%. Using a blend of naturally derived substances and essential oils in appropriate quantities may be a supplementary approach for minimizing the risk of SARS-CoV-2 infection.

Key Words: **Propolis, Antiviral activity, in vitro, SARS-CoV-2,**

Exploring the Diverse Properties of Propolis: A Multidisciplinary Approach

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Abstract

The purpose of the research is to provide a comprehensive understanding of the diverse properties of propolis sourced from three distinct regions in Croatia (Continental, Alpine, and Mediterranean) and two regions in Bavaria (Continental and Alpine). Research includes organoleptic, chemical, and biological aspects of propolis and uses a multi-faceted approach to decipher the properties of propolis. Various analytical techniques are used to determine the properties of propolis. The volatile components are identified using Gas Chromatography-Mass Spectrometry (GC-MS), and the identification of the key odorants is achieved through Gas Chromatography-Olfactometry (GC-O), GC-O/MS and sensory evaluation. These analyses are being conducted at the Department of Chemistry and Pharmacy, Chair of Aroma and Smell Research, Friedrich-Alexander University (FAU) in Erlangen, Germany. Further insights into the composition of propolis are gained through the determination of macro, trace, and toxic elements, performed at the Institute for Medical Research and Occupational Health in Zagreb, Croatia. Additionally, the evaluation of total phenol content and antioxidant activity is carried out at the Department of Food and Nutrition Research at the Faculty of Food Technology in Osijek, Croatia.

To the best of our knowledge, this is the first study to comprehensively characterize the respective properties of Croatian and Bavarian propolis and to relate the results to the geographical origin, thus studying all those factors together. The influence of the geographical region on the propolis is thus related to the different landforms and vegetation. The result of this research will facilitate collection better understanding of propolis and the improved acquisition of desirable qualities for future applications.

Key Words: Bee Product, Geographic Area, Organoleptic Characteristics, Chemical Characteristics, Biological Characteristics

Acknowledgements
This research is funded by a grant provided by the Bavarian Academic Center for Central, Eastern and Southeastern Europe. The analyses are supported by the Department of Chemistry and Pharmacy, Chair of Aroma and Smell Research, Friedrich-Alexander University (FAU) Erlangen, Germany, the Institute for Medical Research and Occupational Health, Zagreb, Croatia and the Department of Food and Nutrition Research, Faculty of Food Technology, Osijek, Croatia.

Overview of Bee Propolis Industry in China

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Abstract

There are about 10 million bee colonies in China in 2022. Bee propolis can be collected in 60% of them when they produce honey, royal jelly or bee pollen. Though the plants source is rich and diverse, the main product is brown propolis (from poplar). The annual output of raw propolis is about 500 tons. Propolis solid ethanol extract is generally used to produce different forms of propolis products, for example, liquid, soft capsules, cosmetics, etc. At present, there are 4 propolis extract-based medicine and 1500 functional foods formula approved by the government, mainly used to regulate immune system, blood glucose, blood lipid and as antioxidant. Propolis is recorded in “Chinese Materia Medica” and “Chinese Pharmacopoeia”, too. Propolis standardization system is set up in China now and ISO Propolis-Specification is going to be published soon.

Key Words: **Bee products, China, Propolis Standardization, Chinese Pharmacopoeia, Chinese Market**

Evaluation of the Botanical Sources, Chemical Components, and Bioactivity Profiles of Several Propolis Samples Collected from Black Sea Region (Türkiye)

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Abstract

Propolis is produced by honeybees (Apis mellifera L.) by collecting resins found in the plant leaves, buds, and stems or plant exudates. Thus, chemical composition which is a key for the determination of the propolis type is highly related with the plant diversity found around the beehive. Several studies have been conducted to reveal its pharmacological activities as antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory effects. However, the gap of these studies was not mentioning the propolis botanical origin (propolis-type). It should be highlighted that for reproducible biological activity, identification of the propolis-type should be the initial step. In this study, several propolis samples were collected from the Black Sea Region in Türkiye. Then, their botanical sources, chemical profiles, and pharmacological activites thoroughly evaluated [1-3]. First, botanical sources were determined by using a high-performance thin-layer chromatography (HPTLC). Then, quantities of the marker components were evaluated by a validated high-performance liquid chromatography (HPLC). HPTLC results showed that there are mainly two types of propolis found in the Black Sea Region: Black poplar-type propolis (originated from Populus nigra L.) and Eurasian aspen-type propolis (originated Populus tremula L.). Moreover, caffeic acid phenethyl ester (CAPE), caffeic acid, chrysin, galangin, pinocembrin etc. were found to be the marker components of black poplar-type propolis whereas phenolic glyserides (Lasiocarpin B and lasiocarpin C) were found for Eurasian aspen-type propolis. Later, chemically well defined different propolis types were subjected to various pharmacological activity studies as antioxidant activity, anti-inflammatory activity, anti-cancer activity, and anti-mutagenic activity. As a result, hydroalcoholic extract of black poplar-type propolis having ≈ 20 mg/g CAPE content showed the most potent activity.

Key Words: **Black poplar-type propolis, Eurasian aspen-type propolis, chemical profiling, pharmacological activity**

Acknowledgements

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References

[1] Guzelmeric, E., Yuksel, P.I., Yaman, B.K., Sipahi, H., Celik, C., et al. 2021. Comparison of antioxidant and anti-inflammatory activity profiles of various chemically characterized Turkish propolis sub-types: Which propolis type is a promising source for pharmaceutical product development? Journal of Pharmaceutical and Biomedical Analysis, 203, 114196. DOI: 10.1016/j.jpba.2021.114196.

[2] Guzelmeric, E., Sipahi, H., Özhan, Y., Hamitoğlu, M., Helvacıoğlu, S., et al. 2023. Comprehensive estrogenic/anti-estrogenic, anticancer, mutagenic/anti-mutagenic, and genotoxic/anti-genotoxic activity studies on chemically characterized black poplar and Eurasian aspen propolis types. Journal of Pharmaceutical and Biomedical Analysis, 226, 115241. DOI: 10.1016/j.jpba.2023.115241.

[3] Guzelmeric, E., Özdemir, D., Sen, N.B., Celik, C., Yesilada, E. 2023. Quantitative determination of phenolic compounds in propolis samples from the Black Sea Region (Türkiye) based on HPTLC images using partial least squares and genetic inverse least squares methods. Journal of Pharmaceutical and Biomedical Analysis, 229, 115338. DOI: 10.1016/j.jpba.2023.115338.

Antioxidative Effect of Propolis vs. Propolis and Ginseng, in Intense Physical Effort

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Abstract

Introduction. Intense physical effort can be a source of oxidative stress. Propolis, a natural mixture of viscous resins, and Ginseng, could improve the antioxidant protection.

Objectives. The objective was to highlight the antioxidant effect of propolis vs propolis and ginseng, on intense physical effort in young amateur fitness practitioners.

Methods. 51 young healthy, amateur fitness practitioners, were randomly blind divided into three groups: subjects who did not receive any product, before intense physical effort (control = C = 13); subjects who received propolis capsules for one month, before intense physical effort (Propolis group = P = 19); subjects who received capsules with ginseng and propolis for one month, before intense physical effort (Propolis+Ginseng group = PG = 19). The evaluated parameters were: interleukin-6 (IL-6), superoxide dismutase (SOD), malondialdehyde (MDA), and total antioxidant capacity (TAC), before and after intense physical exercise.

Results. SOD and TAC serum concentration were upregulated, IL-6 and MDA serum concentration were down-regulated in P and PG, compared to C, after intense physical effort.

Conclusions. A month of treatment with propolis or propolis with ginseng, increased the antioxidant defense after the intense physical effort, in fitness amateur practitioners, the effect being much more intense after using the of propolis and ginseng combination.

Keywords: **Propolis, Ginseng, Oxidative Stress, İntense Physical Effort**

Optimization of Propolis Extraction with Natural Deep Eutectic Solvents and Evaluation of Their Bioactive Content and Antimicrobial Activity

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Abstract

This study investigates the potential of using natural deep eutectic solvents (NADES) for the extraction of phenolic compounds from propolis and optimizes the extraction process using central composite design (CCD). Different NADES mixtures were prepared and analyzed for stability, physicochemical properties and ability to solubilize phenolic compounds and four NADES, namely NADES 62 (Betaine, Malic acid and proline 1:1: The full quadratic model showed that the linear effect of time, temperature and ultrasound amplitude was significant on the models for NADESs and 80% Ethanol. NADES 62 showed the highest extraction yield and the optimum extraction conditions were 80°C, 135 minutes and 100% amplitude. The highest total phenolic and total flavonoid contents obtained for NADESs were 5284.2 mg GAE/L and 1531.2 mg QE/L, respectively. The antimicrobial activity of propolis extracts prepared with NADESs for molds was found to be higher than the extracts prepared with 80% Ethanol. Phenolic profile and antimicrobial activity analyses were carried out with the optimization performed and the information that NADESs can be a good alternative to traditional solvents for propolis extraction was reinforced.

Key Words: **Propolis, Extraction, Natural Deep Eutectic Solvents, Bioactive Content, Antimicrobial Activity.**

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References

[1] Agresti, A., 2018. Statistical methods for the social sciences. Pearson.

[2] Alday, E., Navarro-Navarro, M., Garibay-Escobar, A., Robles-Zepeda, R., Hernandez, J., Velazquez, C., 2016. Advances in pharmacological activities and chemical composition of propolis produced in Americas. In: Chambo, E.D. (Ed.), Beekeeping and Bee Conservation. IntechOpen. https://doi.org/10.5772/63145.

[3] Bankova, V., de Castro, S.L., Marcucci, M.C., 2000. Propolis: recent advances in chemistry and plant origin. Apidologie 31 (1), 3–15. https://doi.org/10.1051/apido:2000102.

[4] Bankova, V., Popova, M., Trusheva, B., 2016. New emerging fields of application of propolis. Maced. J. Chem. Chem. Eng. 35 (1), 1–11. https://doi.org/10.20450/mjcce.2016.864.

[5] Bankova, V., Trusheva, B., Popova, M., 2021. Propolis extraction methods: a review. J. Apic. Res. 60 (5), 734–743. https://doi.org/10.1080/00218839.2021.1901426.

[6] Cannavacciuolo, C., Pagliari, S., Frigerio, J., Giustra, C.M., Labra, M., Campone, L., 2022. Natural deep eutectic solvents (NADESs) combined with sustainable extraction techniques: a review of the green chemistry approach in food analysis. Foods 12 (1), 56. https://doi.org/10.3390/foods12010056.

[7] Clinical and Laboratory Standards Institute (CLSI), 2012. Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard—Eleventh Edition. M02-A11, 2012. CLSI, Wayne, PA.

[8] Clinical and Laboratory Standards Institute (CLSI), 2018. Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically. In: Eleventh Edition M07, 2018. CLSI.

[9] Craveiro, R., et al., 2016. Properties and thermal behavior of natural deep eutectic solvents. J. Mol. Liq. 215, 534–540. https://doi.org/10.1016/j.molliq.2016.01.038.

[10] Dai, Y., Spronsen, J., van, Witkamp, G.-J., Verpoorte, R., Choi, Y.H., 2013. Natural deep eutectic solvents as new potential media for green technology. Anal. Chim. Acta 766, 61–68. https://doi.org/10.1016/j.aca.2012.12.019.

[11] Degirmencioglu, H., Guzelmeric, E., Yuksel, P.I., Kırmızıbekmez, H., Deniz, I., Yesilada, E., 2019. A new type of anatolian propolis: Evaluation of its chemical composition, activity profile and botanical origin. Chem. Biodivers. 16 (12), e1900492 https://doi.org/10.1002/cbdv.201900492.

[12] Deye, J.F., Berger, T.A., Anderson, A.G., 1990. Nile red as a solvatochromic dye for measuring solvent strength in normal liquids and mixtures of normal liquids with supercritical and near critical fluids. Anal. Chem. 62 (6), 615–622. https://doi.org/10.1021/ac00205a015.

[13] Elumalai, P., Muninathan, N., Megalatha, S.T., Suresh, A., Kumar, K.S., Jhansi, N., Kalaivani, K., Krishnamoorthy, G., 2022. An insight into anticancer effect of propolis and its constituents: A review of molecular mechanisms. Evid. -Based Complement. Altern. Med. 2022, 5901191 https://doi.org/10.1155/2022/5901191.

[14] Escobedo-Gonzalez, Cabanas, Gonzalez, Sanchez, Saavedra-Leos, Cruz-Olivares, Serrano, Martínez, Ruvalcaba, 2019. Green approach extraction of perezone from the roots of Acourtia platyphilla (A. Grey): A comparison of four activating modes and supercritical carbon dioxide. Molecules 24 (17), 3035. https://doi.org/10.3390/molecules24173035.

[15] Freitas, D.S., Rocha, D., Castro, T.G., Noro, J., Castro, V.I.B., Teixeira, M.A., Reis, R.L., Cavaco-Paulo, A., Silva, C., 2022. Green extraction of cork bioactive compounds using natural deep eutectic mixtures. ACS Sustain. Chem. Eng. 10 (24), 7974–7989. https://doi.org/10.1021/acssuschemeng.2c01422.

[16] Funari, C.S., Sutton, A.T., Carneiro, R.L., Fraige, K., Cavalheiro, A.J., da Silva Bolzani, V., Hilder, E.F., Arrua, R.D., 2019. Natural deep eutectic solvents and aqueous solutions as an alternative extraction media for propolis. Food Res. Int. 125, 108559 https://doi.org/10.1016/j.foodres.2019.108559.

[17] Ghosh, S., Chakraborty, R., Raychaudhuri, U., 2012. Optimizing process conditions for palm (Borassus flabelliffer) wine fermentation using response surface methodology. Int. Food Res. J. 19, 1633–1639.

[18] Guzelmeric, E., Ristivojevic, P., Trifkovic, J., Dastan, T., Yilmaz, O., Cengiz, O., Yesilada, E., 2018. Authentication of Turkish propolis through HPTLC fingerprints combined with multivariate analysis and palynological data and their comparative antioxidant activity. LWT 87, 23–32. https://doi.org/10.1016/j.lwt.2017.08.060.

[19] Guzelmeric, E., Yuksel, P.I., Yaman, B.K., Sipahi, H., Celik, C., Kırmızıbekmez, H., Aydın, A., Yesilada, E., 2021. Comparison of antioxidant and anti-inflammatory activity profiles of various chemically characterized Turkish

propolis sub-types: Which propolis type is a promising source for pharmaceutical product development? J. Pharm. Biomed. Anal. 203, 114196 https://doi.org/10.1016/j.jpba.2021.114196.
[20] Hansen, B.B., Spittle, S., Chen, B., Poe, D., Zhang, Y., Klein, J.M., Horton, A., Adhikari, L., Zelovich, T., Doherty, B.W., Gurkan, B., Maginn, E.J., Ragauskas, A., Dadmun, M., Zawodzinski, T.A., Baker, G.A., Tuckerman, M.E., Savinell, R.F., Sangoro, J.R., 2021.
[21] Deep eutectic solvents: A review of fundamentals and applications. Chem. Rev. 121 (3), 1232–1285. https://doi.org/10.1021/acs.chemrev.0c00385.
[22] ISO Technical Committee., 2023. ISO/DIS 24381: Bee propolis - Specifications. [Unpublished manuscript/report].
[23] Koutsoukos, S., Tsiaka, T., Tzani, A., Zoumpoulakis, P., Detsi, A., 2019. Choline chloride and tartaric acid, a natural deep eutectic solvent for the efficient extraction of phenolic and carotenoid compounds. J. Clean. Prod. 241, 118384 https://doi.org/10.1016/j.jclepro.2019.118384.
[24] Montgomery, D.C., 2017. Design and analysis of experiments. John Wiley & Sons.
[25] Murador, D.C., de Souza Mesquita, L.M., Vannuchi, N., Braga, A.R.C., de Rosso, V.V., 2019. Bioavailability and biological effects of bioactive compounds extracted with natural deep eutectic solvents and ionic liquids: advantages over conventional organic solvents. Food Microbiol. Funct. Foods Nutr. 26, 25–34. https://doi.org/10.1016/j.cofs.2019.03.002.
[26] Ogihara, W., Aoyama, T., Ohno, H., 2004. Polarity measurement for ionic liquids containing dissociable protons. Chem. Lett. 33 (11), 1414–1415. https://doi.org/10.1246/cl.2004.1414.
[27] Poncet-Legrand, C., Edelmann, A., Putaux, J.L., C artalade, D., Sarni-Manchado, P., Vernhet, A., 2006. Poly(l-proline) interactions with flavan-3-ols units: Influence of the molecular structure and the polyphenol/protein ratio. Food Hydrocoll. 20 (5), 687–697.
[28] Ristivojevic, P., Dimkic, I., Guzelmeric, E., Trifkovic, J., Knezevic, M., Beric, T., Yesilada, E., Milojkovic-Opsenica, D., Stankovi´c, S., 2018. Profiling of Turkish propolis subtypes: Comparative evaluation of their phytochemical compositions, antioxidant and antimicrobial activities. LWT 95, 367–379. https://doi.org/10.1016/j.lwt.2018.04.063.
[29] Rivera-Yanez, N., Ruiz-Hurtado, P.A., Rivera-Yanez, C.R., Arciniega-Martínez, I.M., Yepez-Ortega, M., Mendoza-Arroyo, B., Rebollar-Ruíz, X.A., Mendez-Cruz, A.R., Resendiz-Albor, A.A., Nieto-Yanez, O., 2023. The role of propolis as a natural product with potential gastric cancer treatment properties: a systematic review. Foods 12 (2), 415. https://doi.org/10.3390/foods12020415.
[30] Sagdic, O., Karasu, S., Goktas, H., 2020. Piyasada satilan ticari propolis örneklerinin biyoaktif bileşenlerinin belirlenmesi. Avrupa Bilim ve Teknol. Derg. (19), 19–31. https://doi.org/10.31590/ejosat.734204.
[31] Santana, A.P.R., Mora-Vargas, J.A., Guimaraes, T.G.S., Amaral, C.D.B., Oliveira, A., Gonzalez, M.H., 2019. Sustainable synthesis of natural deep eutectic solvents (NADES) by different methods. J. Mol. Liq. 293, 111452 https://doi.org/10.1016/j.molliq.2019.111452.
[32] Sforcin, J.M., 2016. Biological properties and therapeutic applications of propolis. Phytother. Res 30 (6), 894–905. https://doi.org/10.1002/ptr.5605.
[33] Skulcova, A., Russ, A., Jablonsky, M., Sima, J., 2018. The pH behavior of seventeen deep eutectic solvents. BioRes 13 (3), 5042–5051. https://doi.org/10.15376/biores.13.3.5042-5051.
[34] Snedecor, G.W., Cochran, W.G., 1989. Statistical Methods, 8th edition. Iowa State University Press, Ames.
[35] Socas-Rodríguez, B., Torres-Cornejo, M.V., Alvarez-Rivera, G., Mendiola, J.A., 2021. Deep eutectic solvents for the extraction of bioactive compounds from natural sources and agricultural by-products. Appl. Sci. 11 (11), 4897. https://doi.org/10.3390/app11114897.
[36] Trusheva, B., Petkov, H., Popova, M., Dimitrova, L., Zaharieva, M., Tsvetkova, I., Najdenski, H., Bankova, V., 2019. “Green” approach to propolis extraction: Natural deep eutectic solvents. C. R. Acad. Bulg. Sci. 72 (7), 897–905. https://doi.org/10.7546/CRABS.2019.07.06.
[37] Tzani, A., Pitterou, I., Divani, F., Tsiaka, T., Sotiroudis, G., Zoumpoulakis, P., Detsi, A., 2022. Green extraction of Greek propolis using natural deep eutectic solvents (NADES) and incorporation of the NADES-extracts in cosmetic formulation. Sustain. Chem. 4 (1), 8–25. https://doi.org/10.3390/suschem4010002.

[38] Vasileva, B., Staneva, D., Grozdanova, T., Petkov, H., Trusheva, B., Alipieva, K., Popova, M., Miloshev, G., Bankova, V., Georgieva, M., 2022. Natural deep eutectic extracts of propolis, sideritis scardica, and Plantago major reveal potential antiageing activity during yeast chronological lifespan. Oxid. Med. Cell. Longev. 2022, 8368717 https://doi.org/10.1155/2022/8368717.

[39] Zhang, H., Birch, J., Ma, Z.F., Xie, C., Yang, H., Bekhit, A.E.-D., Dias, G., 2019. Optimization of microwave-assisted extraction of bioactive compounds from New Zealand and Chinese Asparagus officinalis L. roots. J. Food Sci. Technol. 56 (2), 799–810. https://doi.org/10.1007/s13197-018-3540-0.

Multivariate Analysis of Correlation Between Chemical Composition and Biological Activity of Propolis

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Abstract

Propolis is a resinous material collected by honeybees from plants and has diverse biological potential. The location of propolis collection influences its chemical composition, resulting in variations in biological activity. The present study was designed to analyse the relationship of propolis to geographic location, chemical composition, and biological activity. We have applied multiple regression analysis using SPSS. Parameters such as selected flavonoids and phenolics, their total content and biological activities i.e., anti-microbial activity against Staphylococcus aureus in this study. Propolis samples from three climatic zones such as temperate, subtropical, and tropical have been included in the study. The analysis supports the fact that phenolics have stronger anti-microbial activity as compared to flavonoids. Higher levels of cinnamates were observed in propolis from tropical regions which had better anti-microbial potential compared to propolis from temperate region. We also observed that, climatic zone based propolis activity factor approach helps to cater for the best possible biological application of propolis.

Key Words: **Propolis, Anti-microbial, Natural Product, Honeybee, S. Aureous, Statitstical Analysis.**

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A Chewable Lozenge with Propolis as a Promising Cariostatic Agent Dosage Form

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Abstract

Propolis as a natural bee product has a beneficial impact on oral health due to its antibacterial, antiplaque, anti-inflammatory and regenerative action. Due to the antibacterial effect against streptococci of the oral cavity, it is considered a promising agent to decrease the accumulation of dental plaque. It contains polyphenols which are responsible for a favourable effect on the oral microbiota and an antibacterial action. Propolis may be beneficial in the development of dosage forms intended for oral cavity use. The aim of the study was to evaluate the antibacterial action of prepared lozenges with Polish propolis extract against cariogenic bacteria, as well as the stability and susceptibility of the prepared lozenges with propolis under different storage conditions. Physical conditions are supposed to cause the deactivation of biologically active substances responsible for the antibacterial effect of propolis, therefore antimicrobial analysis for lozenges was conducted before and after storage under stress conditions. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined on cariogenic streptococci related to the occurrence of dental caries. The results showed that the MIC and MBC of Polish propolis extract-containing lozenges were lower than 100 µg/mL against the tested microbial strains. Lozenges exposed to stress conditions showed less activity against Staphylococcus in the oral cavity. The evaluation of the antibacterial effect of prepared lozenges indicates a potential role of ethanolic extract of Polish propolis in the prophylaxis of dental plaque.

Key Words: **propolis; antibacterial effect; oral cavity; lozenge; cariostatic agent; oral health**

Propolis Shows Antiatherogenic Activity by Reducing ADAM10 and Sortilin Levels in the Aortic Root

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Abstract

Atherosclerotic plaques, which develop mainly in large arteries, are the leading cause of cardiovascular disease, one of the top causes of death in the world. High cholesterol levels within the subendothelial layer of arterial walls trigger the onset of atherosclerosis, drawing macrophages toward the intimal layer. However, foam cells are formed if lipids exceed the macrophages' capacity to clear them. Sortilin is a transmembrane protein synthesized in various tissues and cells, particularly in the liver and macrophages. It is activated by a disintegrin and metalloprotease(ADAM)10 and plays a role in lipid metabolism and intracellular signaling mechanisms. It is known that sortilin, released from macrophages, increases the growth and number of foam cells by increasing the uptake of low-density lipoprotein(LDL); thus, it is an atherogenic molecule. The anti-inflammatory properties of bee products, especially propolis, which have always been the focus of research from past to present, have been revealed by various studies. However, the effect of propolis on sortilin and ADAM10 levels is unknown. Our investigation focused on the levels of sortilin and ADAM10 in the aortic root of ApoE-/- mice, which we used as an atherosclerosis model. In our study, eight C57BL/6J mice were used as controls, while twenty-four ApoE-/- mice were used for the case, water extract of propolis, and ethanolic extract of propolis groups. Propolis extracts were administered intraperitoneally to mice fed with control and high cholesterol diet for sixteen weeks for the last four weeks. The animals were sacrificed by decapitation, and the aortic root was dissected. The levels of these proteins were investigated immunohistochemically using primary sortilin and ADAM10 antibodies. As a result of the study, propolis extracts significantly

reduced ADAM10 and sortilin levels in the aortic root compared to the case group($p<0.05$). This finding suggests that propolis extracts may hold potential therapeutic benefits in regulating the levels of these proteins.

Key Words: **ADAM10, Atherosclerosis, Propolis, Sortilin**

Chemical and Bioactivity Studies on a New Type of Propolis Botanically Originated from Cistus laurifolius L.

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Abstract

Propolis type is defined according to the plant source that has the highest proportion in its composition. Palynological analysis and chromatographical methods are commonly used to determine its botanical source. However, palynological analysis might fail to produce good results since honeybees can collect resins from unopened buds (i.e., Populus spp.), making it challenging to identify typical pollen grains using microscopy. High-performance thin-layer chromatography (HPTLC) is a useful chromatographic method for identifying different propolis types. In Türkiye, comparative HPTLC chromatograms of propolis samples and plant parts confirmed that quercetin and its derivatives, kaempferol, chrysin, caffeic acid phenethyl ester, galangin, and others were identified as marker components for black poplar-type propolis, whereas Lasiocarpin B and Lasiocarpin C were identified as marker components for Eurasian-aspen-type propolis. Furthermore, a novel type of propolis encoded as 3-methyquercetin (3MQ)-rich propolis was discovered [1]. However, its botanical origin has remained unidentified till today. In this study botanical origin of 3MQ-rich propolis was investigated by comparing HPTLC chromatograms with different plant parts of Cistus spp. Then, anti-inflammatory activity was assessed by evaluating nitrit oxide inhibition comparatively with two positive controls as indomethacin a well-known anti-inflammatory reagent and L-NAME specific nitric oxide sentatase inhibitor. Additionally, the potential anticancer properties of propolis were determined using two different methods: a 2D cell cytotoxicity assay and a 3D spheroid formation assay. The experiments involved the use of two cell lines, MIA PaCa-2 (a human pancreatic cancer cell line) and HDF (human dermal fibroblast cell line).

Initially, the impact of propolis on cell viability was evaluated through the MTT colorimetric assay. Subsequently, results obtained from this assay were compared with the results from the 3D spheroid model. The influence of propolis on the growth of these spheroids was examined by measuring changes in their size using ImageJ software (Image J 2.0, USA).

Key Words: **Cistus laurifolius Originated Propolis, Anti-Inflammatory Activity, Anticancer Activity.**

References

[1] Degirmencioglu, H.T., Guzelmeric, E., Yuksel, P. I., Kırmızıbekmez, H., Deniz, I., and Yesilada, E., 2019. A new type of Anatolian propolis: Evaluation of its chemical composition, activity profile and botanical origin. Chemistry & biodiversity, 16(12), doi: 10.1002/cbdv.201900492.

Propolis and Drug Interactions

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Abstract

Propolis is a bee product that has been used in recent years for the prevention and treatment of diseases due to its many beneficial biological activities. However, its use with some drugs can cause concern. In this study, the effects of using different extracts of propolis with antibiotics, antifungals, cancer drugs and anticoagulant drugs were evaluated. In most of the studies involving the interactions of propolis with different drugs, propolis has shown a synergistic effect with antibiotics and antifungal drugs. It has been determined that propolis prevents the harmful effects of cancer drugs and drugs that damage the liver and kidneys due to side effects, and has a healing effect. However, it has been determined that when used with anticoagulant drugs, especially the use of alcohol extract of propolis with these drugs may have negative effects.

Key words: **Propolis, Drug, Antibotic, Antifungal, Anticoagulant**

1. Introduction

The resinous substance, which is usually secreted from the colleter tissue of the plants, is collected with the help of the mandible of honey bees (Apis mellifera L.), mixed with wax and saliva, turned into pellets and transported to the hive in the pollen basket (corbicula). In this state, the chemical structure of the resin differs, so it is called propolis. In fact, when we look at its function in nature, the resin produced by the plant is necessary for the protection of the plant bud from micro-organisms and for the continuation of the generation, while propolis is essential for the protection and survival of the honey bee.

Honey bees collect resin and produce propolis to maintain homeostasis, to prevent uncontrolled air flow in the hive, to reduce microbial growth, to waterproof the hive walls, to strengthen the structural stability in primitive hives, to narrow/close the entrances and holes that will make the hive vulnerable, and to prevent stinking of dead creatures in the hive. Recent studies have shown that propolis provides colony-level immunity and provides defense against parasites and pathogens. Honeybee colony propolis, which collects more propolis in fungal infections such as Nosema (honey bee disease), has shown that it is used not only for prophylactic but also for therapeutic purposes.

In a study investigating the antimicrobial activity of propolis, Mirzoeva et al. (1997) investigated the effect of propolis on the physiology of B. subtilis, E. coli and R. sphaeroides microorganisms. It is thought that propolis affects the ion permeability of the bacterial membrane and causes the deterioration of the membrane potential. The electrochemical gradient of protons crossing the membrane is necessary for bacteria to survive due to ATP synthesis, membrane transport and motility. The effect of propolis on membrane potential and permeability contributes to its cytotoxic activity in general, and together with other antimicrobial components, it can reduce the resistance of bacteria. This is also explained by the synergistic effect of propolis with some antibiotics. Some compounds of propolis, such as CAPE and quercetin, act as ionophores, causing inhibition of bacterial motility. Considering that bacterial motility and chemotaxis guide the adhesion and invasion of bacteria to the relevant sites, the importance of this effect becomes apparent. As a result, it has been shown that propolis components play an important role in the antimotility (immobility) action in bacteria, inhibition of bacterial pathogenesis and infection development. These compounds are thought to be possibly flavonoids and caffeic acid esters. However, it is emphasized that pure propolis components containing cinnamic acid derivatives (caffeic acid and CAPE) and flavonoids (quercetin and naringenin) affect the bacterial membrane potential and mobility, and that the bacteriostatic and bacteriocidal effects of propolis are probably the result of the combined effect of such compounds.

Scazzocchio et al. (2006) investigated the antibacterial activity of sub-inhibitor concentrations of propolis ethanol extract (EEP) and its effects on antibacterial activity with some antibiotics. Clinical isolates of gram positive bacteria strains were used in the study. In addition, the effects of sub-inhibitor concentrations of EEP on some important virulence factors such as lipase and coagulase enzymes and biofilm formation in S. aureus were investigated. EEP was found to have significant antimicrobial effect on all clinical isolates tested. In addition, it was found that adding EEP to the tested antibacterial drugs strongly increased the antimicrobial effect of ampicillin, gentamycin and streptomycin.

The tested antibacterial drugs are; gentamycin (GENT), streptomycin (STREP), ceftriaxon (CFT), erythromycin (ERIT), vancomycin (VANC), chloramphenicol (CLM), ampicillin and their concentrations are 1 mg/ml. The effectiveness of the propolis tested in the study was probably attributed to the functional and structural damage to the microbial membrane or cell wall by the flavonoids (quercetin, galangin, pinosembrin and caffeic acid, benzoic acid, cinnamic acid). In another study comparing the antimicrobial effect of propolis with conventional antibiotics, Krol et al. (1993) tested the effect of propolis and antibiotics (Penicillin G, doxycycline, streptomycine, cloxacillin, chloramphenicol, cafradine, ampicillin and polymyxin B together with EEP (600 ug/ml)) on S. aureus. Propolis together with streptomycin and cloxacillinergic antibiotics showed a moderate synergistic effect with others except ampicillin.In another study, which found that propolis had a synergistic effect with antibiotics in terms of drug interaction, a synergistic effect was observed between propolis and ciprofloxacin in S. aureus keratitis.Orsi et al. It has been determined that it reduces the wall resistance and shows a synergistic effect on the ribosome with antibiotics (amoxicillin, ampicillin, and cefalexin).

The results of these studies proved that when propolis is taken together with antibiotics, it will have an increasing effect, not reducing their effect.

In addition, 3 common classes of antifungal drugs for the treatment of invasive fungal infections; polyenes (Amphotericin B), azoles (ketoconazole, itraconazole, fluconazole) and flucytosine. Although amphotericin B has a wide spectrum of activity, the drug has various side effects, especially nephrotoxicity. Some have improved tolerability profiles; however, their intensive use has led to the emergence of resistance in susceptible strains. For this reason, there is a need for new antifungal drugs with improved pharmacological properties, expanded spectrum of activity, increased efficacy and better tolerated. Candida species are eukaryotic opportunistic pathogens and are among the leading causes of nosocomial infections in the world. There are more than 200 species of Candida, of which Candida albicans is the most common cause of non-invasive skin and mucous candidiasis. Koc et al. (2005) compared the in vitro activity of propolis against 29 strains of dermatophytes with conventional antifungal drugs such as terbinafine, itraconazole, ketaconazole and fluconazole. Among the tested systemic antifungals, terbinafine was the most potent, while propolis showed significant antifungal activity. Later, Silici et al. (2007) determined the in vitro sensitivity of some yeasts isolated from patients with superficial mycosis to propolis and antifungal drugs. Tested agents; fluconazole, itraconazole, ketoconazole, terbinafine and propolis, broth microdilution technique was used in the study. For all Candida albicans isolates isolated from patients with superficial (superficial) mycosis, ketoconazole showed higher efficacy ($P<0.05$) than other tested antifungal agents, while propolis showed significant antifungal activity against the tested yeasts. Based on these results, researchers suggested the use of propolis as a potential agent for the treatment of superficial mycosis. In another study by this team, Koç and Silici (2008) compared the in vitro activity of ITC (itraconazole) and propolis against 29 clinical isolates of dermatophytes, following the NCCLS guideline for testing filamentous fungi. It has been reported that propolis is a potentially usable natural product for the treatment of dermatophytosis. It has been shown in various studies that flavonoids, one of the active components of propolis, are effective on Herpes simplex virus (HSV-1 and HSV-2), Sindbis virus, parainfluenza-3 virus, human cytomegalovirus, dengue virus type 2. It has been proven that propolis has an antiviral effect on Herpes simplex virus (HSV-1 and HSV-2) and human immunodeficiency virus (HIV, human immunodeficiency virus).

In a study conducted in Türkiye, Yıldırım et al. (2016) investigated the antiviral activities of Hatay propolis samples against HSV-1 and HSV-2 in HEp-2 cell line, and whether propolis has synergistic effects against these viruses together with acyclovir. HSV-1 and HSV-2 replication was significantly suppressed in the presence of 25, 50 and 100 µg/mL propolis (Hatay). It was found that propolis started to inhibit HSV-1 replication after 24 hours of incubation, and propolis activity against HSV-2 started 48 hours after incubation. The activity of propolis against both HSV-1 and HSV-2 was confirmed by a significant reduction in the number of viral replications. It was determined that Hatay propolis samples have significant antiviral effects when compared with acyclovir, especially the synergy produced by the antiviral activity of propolis and acyclovir has a stronger effect against HSV-1 and HSV-2 than acyclovir alone.

While anabolic androgenic steroids such as Boldenone can increase lean muscle mass, strength, and the ability to train longer and harder, the serious side effects of the steroid are numerous and may not be reversible. Barakat et al. (2015) investigated the role of propolis in ameliorating the liver and kidney damage induced by boldenone in male rats. Intramuscular injection of boldenone in rats compared with the control group GGT, GPT, urea, creatinine, cholesterol, triglycerides, HDL, albumin, total protein, sodium (Na), calcium (Ca), magnesium (Mg), malondialdehyde (MDA), liver Nitric oxide (NO), total protein, total thiol, catalase activity and superoxide dismutase activity (SOD) were increased in kidney and kidney tissues. On the other hand, a significant decrease was observed in LDL, alkaline phosphatase (ALP), potassium (K), total lipid and glutathione (GSH) in the boldenone group compared to the control group. These findings suggest that the misuse of boldenone can contribute to liver and kidney damage, so teens need to be especially careful if they want to use these steroids to increase their strength and stamina. In this study, it has been shown that it can be used safely with propolis to heal boldenone-induced liver and kidney damage in male rats.

Nephrotoxicity due to cytotoxic drugs is one of the most common side effects of chemotherapy. The nephrotoxic effect of cancer drugs can also cause serious damage up to serum electrolyte irregularity, serum creatinine increase, GFR decrease and permanent renal failure. Cisplatin, one of these drugs, is one of the most commonly used antineoplastic drugs with the most nephrotoxic effect.

The antitumoral property of propolis helps to reduce the cancer stem cell population, block specific oncogene signaling pathways, anti-angiogenesis, strengthen the antioxidant status and reduce the side effects of the drugs used. Various studies have shown that the anticancer properties of chrysin, caffeic acid phenethyl ester (CAPE), artepillin C (Brazil propolis active ingredient), nemorozone, galangin, cardanol, cardol, quercetin, campferol and pcoumaric acid, among the contents of propolis.

Albukhari et al. (2009), administration of 45 mg/kg/day tamoxifen for 10 consecutive days caused serum ALT, ALT and ALP elevation, glutathione (GSH) decrease, and oxidized glutathione (GSSG) and lipid peroxidation accumulation in female rats. In addition, tamoxifen caused inhibition of hepatic activity of glutathione reductase (GR), glutathione peroxidase (GPx), superoxide dismutase (SOD) and catalase (CAT). In addition, it increased tumor necrosis factor alpha (TNF-alpha) and induced histopathological changes. Previously administered CAPE (2.84 mg/kg/day i.p. for 20 consecutive days starting 10 days before tamoxifen injection) significantly prevented the elevation of serum activity of the aforementioned enzymes. CAPE prevented tamoskifen-induced hepatic GSH reduction and LPO accumulation. It also normalized GR, GPx, SOD and CAT activities, inhibited TNF-alpha elevation, and improved histopathological changes. As a result, CAPE showed a protective effect against tamoxifen-induced liver toxicity. In another study, Gonzalez et al. (1994) tested the effects of propolis extract in mice in a model of acute hepatotoxicity induced by high-dose oral (600 mg/kg) paracetamol. At the end of the experiment, propolis significantly decreased the ALT activity that was elevated by paracetamol in the serum of mice and increased the decreased concentration of glutathione consumed by paracetamol in the mouse liver. In addition, while reducing paracetamol-

induced liver damage in mice, this liver-protecting effect of propolis appeared when administered 30 minutes before or 2 hours after paracetamol. The use of methotrexate, one of the widely used cytotoxic drugs, is restricted because it causes severe liver damage.

Baykara et al. (2015) demonstrated that creatine urea, MDA, GSH, SOD and GSH-Px levels increased in rats as a result of administration of contrast agent (Diatrizoate), and propolis normalized these values as effectively as N-acetyl cysteine and showed kidney protective activity.

Han et al. (2005) determined the effect of 50% propolis cream and silver sulfadiazine (SSD) for the healing of burn wounds in rats. With the results they obtained, the researchers stated that the ointment containing 50% propolis had a curative effect on the healing of burn wounds.
Silici and Karakaya (2023) evaluated possible interactions between propolis and some anticoagulant drugs in an experimental animal model in terms of liver enzymes and International Normalized Ratio (INR) values. Olive oil extract of propolis (200 mg/kg day) and anticoagulant drugs (warfarin apixaban and dabigatran) were given orally to the groups by gavage for one month. Liver enzyme levels (ALT, AST, ALP) and INR levels were determined in blood samples taken from rats, and histopathological examinations were made in heart and liver tissue. The highest LDH enzyme activity was observed in ApIX, E, EEP, EEP+APIX groups. This result shows us that ethanol-based propolis can significantly increase the LDH enzyme activity, which is one of the liver enzymes, when used with Apixaban. In terms of PT, ZYP and ZYP+WAR had the lowest PT values, while EEP+WAR had the highest PT values ($p<0.01$.

Conclusion

In most of the studies involving the interactions of propolis with different drugs, propolis has shown a synergistic effect with antibiotics and antifungal drugs. It has been determined that propolis prevents the harmful effects of cancer drugs and drugs that damage the liver and kidneys due to side effects, and has a healing effect. However, it has been determined that when used with anticoagulant drugs, especially the use of alcohol extract of propolis with these drugs may have negative effects.

References

[1] Barakat, L. A., Tousson, E., Ibrahim, W., & El-Hakeem, A. A. (2015). Role of propolis in improving hepatic and renal damage in boldenone undecylenate in male rats. American Journal of Biological Chemistry, 3(1), 8-15.

[2] Albukhari, A. A., Gashlan, H. M., El-Beshbishy, H. A., Nagy, A. A., & Abdel-Naim, A. B. (2009). Caffeic acid phenethyl ester protects against tamoxifen-induced hepatotoxicity in rats. Food and Chemical Toxicology, 47(7), 1689-1695.

[3] Baykara, M., Silici, S., Özçelik, M., Güler, O., Erdoğan, N., & Bilgen, M. (2015). In vivo nephroprotective efficacy of propolis against contrast-induced nephropathy. Diagnostic and Interventional Radiology, 21(4), 317-321.

[4] González, R., Remirez, D., Rodriguez, S., González, A., Ancheta, O., Merino, N., & Pascual, C. (1994). Hepatoprotective effects of propolis extract on paracetamol-induced liver damage in mice. Phytotherapy Research, 8(4), 229-232.

[5] Han, M. C., Durmus, A. S., Karabulut, E., & Yaman, I. (2005). Effects of Turkish propolis and silver sulfadiazine on burn wound healing in rats. Revue de Médecine Vétérinaire, 156(12), 624-627.

[6] Koç, A.N., Silici, S., Ayangil, D., Ferahbaş, A., Çankaya, S. (2005). Comparison of in vitro activities of antifungal dgrugs

and ethanolic extrat of propolis against Trichophyton rubrum and T.mentagrophytes by using a microdultion assay. Mycoses, 48(3), 205-210.
[7] Koç, N.A., Silici, S. (2008). Comparative study ofin vitro methods used to analyse the antifungal activity of propolis againstTrichophyton rubrum andTrichophyton mentagrophytes . Ann. Microbiol. 58, 543–547.
[8] Krol, W., Scheller, S., Shani, J., Pietsz, G., & Czuba, Z. (1993). Synergistic effect of ethanolic extract of propolis and antibiotics on the growth of Staphylococcus aureus. Arzneimittel-Forschung, 43(5), 607-609.
[9] Scazzocchio, F., Dauria, F. D., Alessandrini, D., & Pantanella, F. (2006). Multifactorial aspects of antimicrobial activity of propolis. Microbiological Research, 161(4), 327-333.
[10] Silici, S., Koç, A.N., Ayangil, D., Çankaya, S. (2005). Antifugal activities of propolis collected by different races of honeybees against yeasts isolated from patients with superficial mycoses. Journal of Pharmacological Sciences, 99(1): 39-44.
[11] Yildirim, A., Duran, G. G., Duran, N., Jenedi, K., Bolgul, B. S., Miraloglu, M., & Muz, M. (2016). Antiviral activity of hatay propolis against replication of herpes simplex virus type 1 and type 2. Medical Science Monitor: International Medical Journal of Experimental and Clinical Research, 22, 422-430.

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