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Review Article

**REVIEW ON MEDICAL VALUES OF HONEY BEE VENOM  
AND THEIR BIOLOGICAL ACTION AND HEALTH BENEFITS****Ajay Kumar Sahu<sup>1\*</sup>, Barsha Rani Kar<sup>2</sup>, Suprava Padhy<sup>2</sup>, Rutuparna Samal<sup>2</sup>, Bani Bandana Sahu<sup>2</sup>, Suman Nayak<sup>2</sup>, Dr. Kirankumar<sup>3</sup>, Dr. Ditikrishna Sahu<sup>4</sup>**<sup>1</sup>Dept. of Microbiology, Bangalore University, Bangalore, Karnataka, <sup>2</sup>Dept. of Biotechnology, AMIT college, Utkal University, Odisha, <sup>3</sup>Dept. of Biotechnology, Reva University, Bangalore,<sup>4</sup>Dept. of Environment Science, Sambalpur University, Odisha.**Abstract:**

Honey bees are the golden insects that produce honey and others vital honey bee products, the best primary of honey bees are honey and bee wax, but pollen, royal jelly, bee venom, queen venom and their larvae are also marketable primary bee products. Medicinal use will increase once better and more details studies are completed. Honey has medicinal use like antiseptic and wound healing properties while propolis is used to treat diabetes patients. Pollen has antioxidant property and anticoagulant and anti inflammatory properties of bee venom serve to treat arthritis and other inflammatory condition.

Honey bee venom is use of live bee inject able venom to treat various disease such as arthritis, multiple sclerosis, disease of central and peripheral nervous system, heart disease and blood system, skin disease and other disease. Honey bee venom is complex mixture of variety of peptide and protein which has strong neurotoxin and immunogenic effects, there are several health benefits that honey bee products such as honey, propolis, royal jelly on different metabolic disease, cancer and other disease have been reviewed. The potential health benefits of honey such as microbial inhibition, wound healing and its effect on their disease.

Bee venom therapy is therapy which utilizes the application of bee venom to treat various diseases and it has been used since ancient time in traditional medicine.

**Keywords:** Honey bee venom, medicinal value, biological action, health benefits, cancer activity, honey bee products.

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**INTRODUCTION:**

Honeybee venom is transparent liquid which dries up easily at room temperature, it is characterized by its Odorless nature ornamental pungent smell, a bitter taste, hydrolytic blends of protein with pH 5.0- 5.5 that use by bees for defense, bee venom is soluble in water and insoluble in alcohol and ammonium sulphate.

The use of natural honey and other honeybee products as food time medicine by mankind has been in

existence from time immemorial, natural honey and other honeybee products are widely embraced by all ages and it is uses transcends the barriers of culture and ethnicity. The use of bee products such as honey, pollen, royal jelly, bee venom and wax to treat some disease liver, cardiovascular and gastrointestinal problems, honeybee and other honey products had a valued place in traditional medicine as well as modern therapeutic for centuries.



Currently honeybees are targeted towards investing directed health benefits and pharmacological properties of bee products due to their effect, leading properties development of nutraceuticals and functional foods from these products, the concept of functional foods refers to foods that has the ability to promote better physiological and psychological health compared to promote better remediated and nutritional food.

The most commonly honeybee venom has been used as traditional method is bee venom acupuncture which involves the injection of diluted bee venom into acupuncture points, it can be employed as an alternative medicine in patients with pain and other inflammatory disease, currently several treatments for disease like cancer are very costly and have numerous side effects due to anticancer drug development from natural resources are ventured throughout the worlds, venoms of several animal species including bee have been shown promising therapeutic potential against cancer.

Honey is sweet liquid processed by the honeybee, honey is recognized worldwide due to its high nutritive components that are beneficial for human well being. It has been used as remedy for cough, sore

throat and earaches, lotus honeybee has been traditionally used to treat eye infection and other disease, in addition to being used to extremely honey bee also used either internally as a functional foods to provides energy and nourishment to enhance vital organ in the body, Bee venom contain at least 18 active substance the most prevalent substance militant which is one of the most potent anti inflammatory agents knows and 100 more potent than hydrocortisol. Adolapin is strong anti inflammatory that inhibits cyclooxygenase. Honeybee venom therapy is not a single mechanism it is explain a wide range of treatment application several mechanism have bee venom proposed.

Honey is also knows as a supersaturated sugar solution, natural honey is composed of 82.4% carbohydrates, 38.5% fructose, 31% glucose, 12.4% other sugar, 17.2% water, 0.3% of protein, organic acids, amino acid, vitamins, phenols and other minor compounds.

Various useful products generally found from honey bee from which the followings are the major products which have great application in medicinal field.

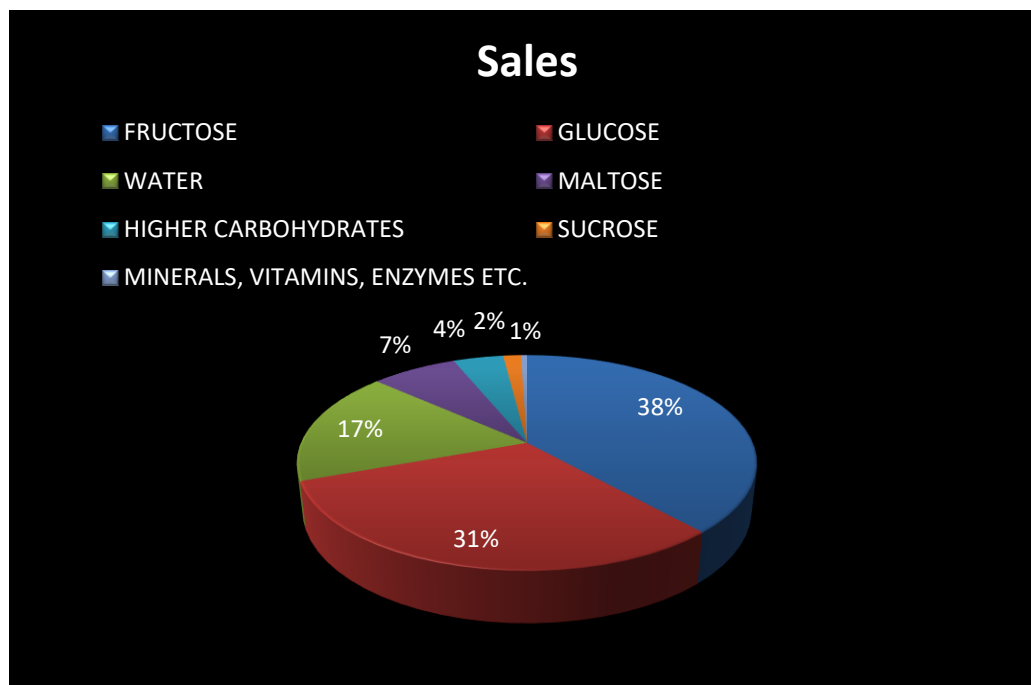
**1. Honey**



The most commonly known apitherapy product includes a golden liquid, Honey. It is of various colour and taste according to the geographical region it originates from. It has two types of indications i.e. internal and external. It has various antimicrobial and outstanding wound healing properties. Here we will discuss about the various components of honey and also its biological activities and health benefits.

#### A. Chemical composition of honey.

Honey is called as supersaturated sugar solution.



Natural honey is composed of 82.4% carbohydrates, 38.5% fructose, 31% glucose, 12.9% other sugars, 17.1% water, 0.5% protein, organic acids, multi minerals, amino acids, vitamins, phenols and other minor components. It also consists of a little amount of biologically active compounds like Phenolic acid, ascorbic acid, flavonoids and  $\alpha$ -tocopherol.

#### B. Biological activities of honey.

Honey has great antimicrobial properties. And thus used in various life saving drugs as an antibacterial agent. The mechanism behind the antibacterial properties of honey is performed by four main properties of honey.

- I. Honey dehydrate the bacteria by taking out all moisture to the environment. The sugar

content of honey is also very high to prevent the growth of microbes.

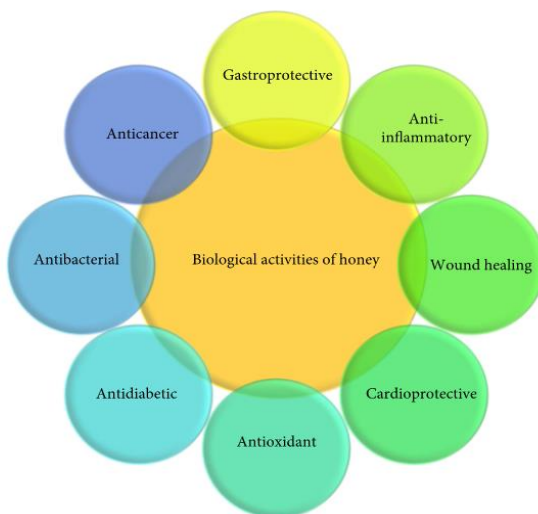


Figure 1: Various types of biological activities of honey products.

- II. The pH of honey is about 3.2-4.5 ,which is very low enough to hinder the microbial growth.
- III. Hydrogen peroxide produced by glucose oxidase is the third and most vital antimicrobial component. But sometimes the peroxide activity in honey may be destroyed for excess heat or by application of catalase.
- IV. Some other non-peroxide products such as methyl syringate and methylglyoxal(MGO) have been found to be responsible for the unique antimicrobial activities of honey.
  - Wound Healing.

#### C. Health benefits of honey.

- Diabetic foot ulcer(DFU).

Honey is a cheap and effective treatment for DFU. Microbial infection slows down the healing process of DFU . Apat from that symptoms such as pain, redness and swelling might not be present for diabetic peripheral neuropathy patients due to their reduced immune response. Besides that there is outstanding tolerability and less trauma to the wound bed in the presence of honey.



There are various evidence of traditionally use of honey to treat wounds, insect bites, burns, skin disorders, sores and boils. As a antimicrobial agent honey is a good promoter for healing wound. Honey promote the activation of dormant plasminogen in the wound matrix, which results in the dynamic expression of the proteolytic enzyme. Plasmin causes blood clot retraction and fibrin destructions. Various other evidences are also found that honey causes wound healing in those cases where antiseptics and antibiotics does not work.

- Gastrointestinal disorder.

Natural honey is composed of enzymes that facilitate the absorption of molecules, such as sugars and starch. Pure honey has bactericidal properties against pathogenic bacteria and enteropathogens, including *Salmonella* spp., *Escherichia coli*, *Shigella* spp., and many other Gram negative species. The gastrointestinal tract (GIT) contains many important beneficial microbes like *Bifidobacteria*. The biological activities and development of this bacteria are further enhanced in the presence of prebiotics. Studies have shown that natural honey contains high amount of prebiotics and thus very healthy for GI tract.

- Pharyngitis and Coughs.

Pharyngitis is a common acute disease and also called as sore throat induced by *Streptococcus* spp. It is found that the problem of sore throat can be treated by the anti-inflammatory, antiviral and anti fungal properties of honey. The antioxidant and antimicrobial properties

of honey helps in minimizing persistent cough and ameliorated sleep for both children and adults. It is also demonstrated that honey is very useful in curing pneumonia.

- Metabolic and Cardiovascular Health.

Honey help in balancing metabolic and cardiovascular health. Honey contains cardioprotective effects such as vasodilation, maintaining vascular homeostasis, and improvements in lipid profile. Flavonoids in honey develops coronary vasodilation, reduces the capability of platelets to form clots, avoid oxidation of low-density lipoproteins (LDL), increases high-density lipoproteins (HDL), and advances endothelial functions.

- Cancers.

Honey helps in reducing the chance of liver, colon and breast cancers.

## 2. Bee Venom

Bee venom is a transparent liquid generally synthesized in the two glands linked with the sting apparatus of worker and queen bees. The production of the bee venom increases during the first two weeks of his life and reaches to its maximum when the bee is in high defence condition. The queen's secretion is during emergency or during battle with other queens. It is generally used to cure various types of syndromes.

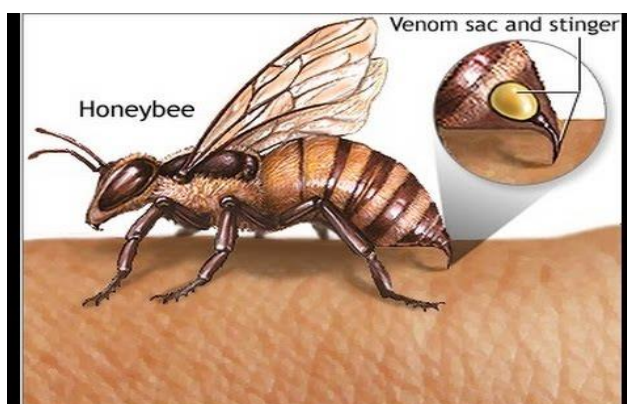




#### A. Chemical composition of bee venom.

The bee venom composed of various types of peptides, enzymes and biogenic amines and also some volatile substances which are generally lost during collection. It contains 88% of water. There are some other contents

like glucose, fructose and phospholipid which are generally same as the blood of bee. Some low molecular weight substances like amino acids, catecholamines, sugars and minerals are also present in bee venom.



#### B. Biological activities of bee venom.

Melittin is the main component of bee venom and it has many positive biological effects and relatively low toxicity, whereas MCD peptide and Phospholipase A2 are the most toxic components. Bee venom is generally used to treat many inflammatory disorders due to its anti-inflammatory properties. It contains peptides, at low concentration peptide is a strong mediator of mast cell degranulation and histamine release from mast cells, which are present in the blood

supply and in all tissues perfused by blood. The enzymes present in bee venom are phospholipase and hyaluronidase which are major enzymatic proteins. These enzymes can trigger an immune response, provoke IgE response in susceptible individuals. The little amount of low molecular weight substances like amines, catecholamines, sugars and minerals are generally permeability of capillaries and increase heart beat. These are some of the biological activities of bee venom.



### C. Health benefits of bee venom.

- **Bee venom in curing Arthritis.**

Bee venom take part in curing Arthritis by two mechanisms i.e. firstly, an anti-inflammatory action through corticosteroids or through an as yet undetermined mechanism or secondly, modification of the immune response, through antigen competition. It blocks the building of the pro inflammatory substances cytokine, PGE-2, NO, Tumor Necrosis Factor TNF-2 and Enzyme COX-2, and hindering the proliferation of rheumatoid synovial cells.

- **Bee venom in curing cancer and tumors.**

Bee venom is an Apitoxin widely used for the treatment of tumors and also some immune-deficiency diseases. By the action of bee venom peptides such as melittin and phospholipase A2, several cancer cells including renal, lung, liver, prostate, bladder, mammary cancer cells and leukemia cells can be treated.



- **Bee venom in curing Heart and Blood System Abnormalities.**

Bee Venom increases coronary and peripheral blood circulation, slows down heart at lower doses and stimulates it at higher ones, lowers blood pressure, antiarrhythmic against blood coagulation and fibrinolytic, stimulates the building of erythrocytes.

- **Bee venom in curing Liver Fibrosis.**

It is demonstrated that melittin control the expression of pro-inflammatory cytokines via the nuclear factor (NF- $\kappa$ B) signaling pathway and prevents TAA-induced liver fibrosis by inhibiting liver inflammation and fibrosis.

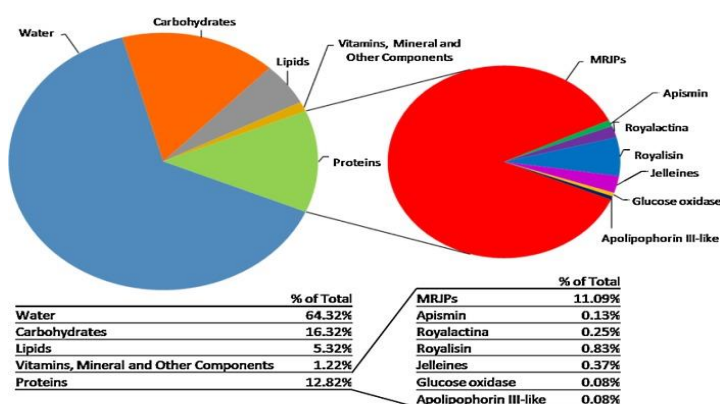


- **Bee venom in curing Skin Diseases.**

Bee venom are also used in curing various types of skin diseases like eczema, dermatitis, psoriasis furunculosis (recurring boil), cicatrices, baldness, acne and other diseases.

### 3. ROYAL JELLY:

Royal jelly is honeybee secretion that is used in nutrition of larvae, as well s adult queens; it is secreted from the glands in the hypo pharynx of nurse bees and fed to all larvae in the colony, regardless of sex or caste. Royal jelly is secreted from the gland in the heads of worker bees and is fed to all bee larvae, whether they are destined to become drones, sterile females or fertile females.



#### A. Chemical Composition

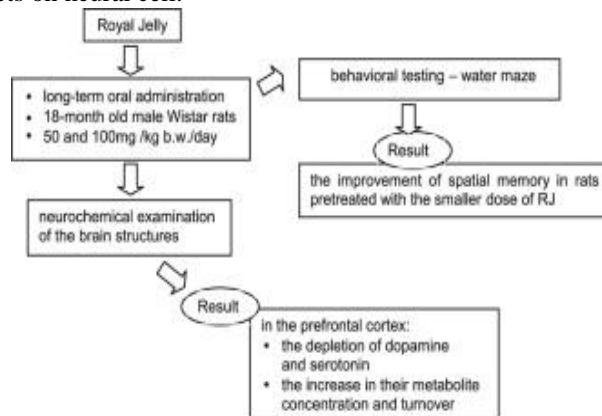
Royal jelly is 67% water, 12.5% protein, 11% simple sugar, 6% fatty acid and 3.5% 10- hydroxyl 2- decenoic acid. It also contains trace minerals, antibacterial and antibiotic components, pantothenic

acid, pyridoxine and trace amount of vitamin c and some fat soluble vitamins A, D, E K.

#### B. Biological Activities



- i. **Antioxidative activity** - Recently enzymatic hydrolysis, water and alkaline extract of royal jelly have been tested for antioxidant properties, it has been shown that royal jelly collected 24 hours after the larvae transfer has the strong antioxidant action.
- ii. **Neurotrophic action** – Royal jelly has been traditionally known as improve memory, prevent senility, increase energy, reduce anxiety and clam hyperactive, in this area there are studies on royal jelly and some of its compound that have effects on neural cell.
- iii. **Insulin action**- Royal jelly can reduce blood sugar level via insulin like peptide and other compound like chromium, sulphur, vitamin B3, royal jelly is also capable to sustain the optimal blood level of sugar by taking part in the oxidation of glucose to obtain energy.
- iv. **Antitumor action** – The mechanism of anti tumor action was attributed to the 10 HAD contained in the royal jelly, a substance that demonstrated inhibitory action on vascular growth factor that induced angiogenesis.



### C. Health benefits

- **Reproductive health**- Clinically study has reported the royal jelly is effective in reducing premenstrual syndrome, royal jelly has protective effect against oxymetholone induced reproductive toxin which is an active steroid derived from testosterone as defense mechanism.
- **Molecular mechanism**- it is responsible for the ant aging activity of royal jelly are the quality of oocytes decrease with age and the depleted follicle pool has tens to hormonal deregulations.

## HEALTH BENEFITS OF ROYAL JELLY

Organic Facts



Aids in weight loss

Helps to prevent breast cancer

Prevents premature aging of cells

Promotes healthy digestion and improves liver function

Reduces stress on blood vessels and prevents heart diseases

Eliminates wrinkles, prevents hair loss and macular degeneration

Boosts cell regeneration, development and growth of muscles and bones

Caution: May cause allergy

www.organicfacts.net

#### 4. BEE WAX:

Bee wax is natural secretion from wax glands on the sides of the body of honey bees and is used primarily as a building block for the bees honeycomb cells in which the young are raised and honey and pollen are stored, it is second most abundant bee live product which has high economic value and a good trade commodity.



##### A. Chemical Composition.

Acid esters- 4%, cerotic acid-4.4%, Lauryl palmitate- 2%, lignoceric acid-1%, Melissic acid- 2%, Monotonic acid- 2.6%, Myricyl palmitate – 23%, myricyl cerotate- 12%.

##### B. Biological activities

###### a) Antimicrobial activity

The antimicrobial activity of natural products and especially product of the hive is gaining importance

and unlike other bee products, bee wax has been only recently studied, considerable work has been done by bee wax methanol and ethanol extracts.

Bee wax has been used since ancient times for its antimicrobial properties in European and Asian traditional medicine, preservative effects are possibly at the basis of its use in embalming and mummification practice by old old model of death mask.



# TOP BEESWAX BENEFITS & USES



-  **Skin Enhancer**  
Beeswax inhibits the growth of bacteria, which can prevent and treat skin conditions like dermatitis, psoriasis and eczema.
-  **Skin Moisturizer**  
It helps protect and repair rough, dry or chapped skin because it has the ability to lock in moisture.
-  **Liver Protector**  
Beeswax helps normalize liver function and improve symptoms of fatty liver disease.
-  **Cholesterol Stabilizer**  
Its compounds lower bad cholesterol and raise good cholesterol.
-  **Pain Reliever & Anti-Inflammatory**  
Its anti-swelling effects help reduce inflammation and relieve pain.
-  **Acne Treatment**  
It has strong antiseptic, healing and anti-inflammatory properties making it effective in the treatment of acne.
-  **Lip Healer**  
The natural moisturizers in beeswax make it the perfect lip balm to heal dry, cracked lips.
-  **Stretch Mark Eliminator**  
The vitamin A in beeswax helps produce collagen, which fights stretch marks.
-  **Jock Itch & Fungal Skin Infection Reliever**  
It helps reduce inflammation, pain and itching associated with fungal infections.
-  **Relaxer**  
Beeswax candles are great aromatherapy agents.

**Dr. Axe**  
FOOD & MEDICINE

## b) Dermatological and cosmetic

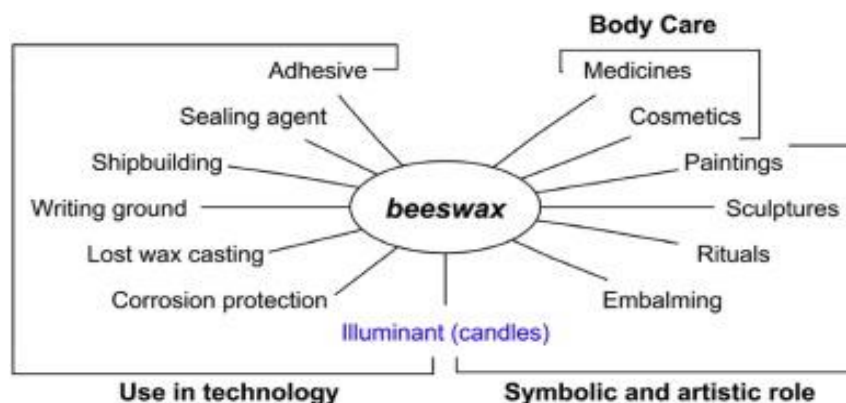
Bee wax has been known as a major Ayurvedic remedy for inflammation, bruises and crack heel, ointment based on the bee wax useful for joint pain, wound and burns are reported in Ebers papyrus.

## C. Health benefits

- Bee wax is also harvested from hives during peak harvesting season, moisturizing components of

bee wax locks in moisture and can help keep the skin firm and plump, the anti allergic and anti inflammatory properties soothe easily irritated skin.

- Bee wax can also act as a layer of protection when applied to the skins; it can protect skin from environmental irritants and extreme weather. Bee wax not only moisture and soothe hair but also can keep moisture from getting out of the hair.



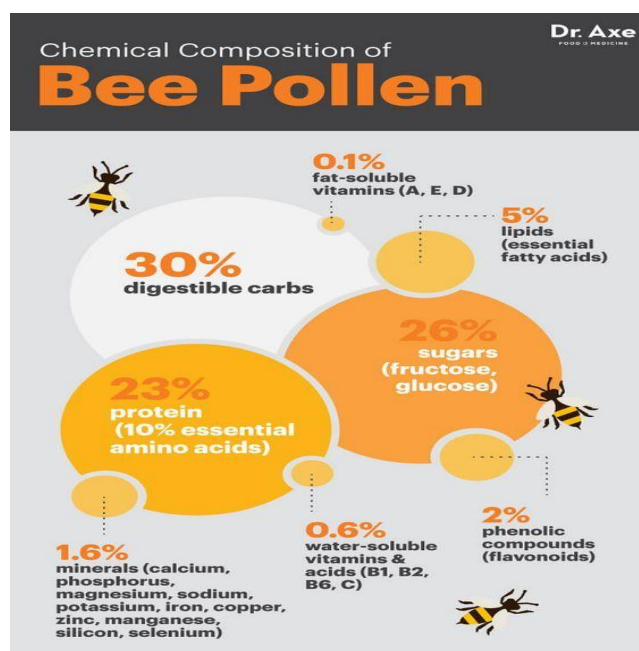
## 5. BEE POLLEN:

Bee pollen is an agglomerate of pollen grains from various botanical sources, which are collected by the bees and mixed with nectar and secretion from the hypo pharyngeal glands such as beta glycosidase enzyme, bee pollen has a complex chemical composition constituted to carbohydrate, protein, amino

acid, vitamins and minerals is considered a good nutritional sources.

### A. Chemical Composition

Sodium-8.9%, potassium- 3.8%, calcium-1.08%, iron- 23.5%, zinc – 19.5%, protein-23%, essential amino acid- 10%, minerals – 1.6%, vitamins- 0.6%, phenolic compound-2%, digestible carbs – 30%, lipids- 5%.



### B. Biological activity

- ✓ Prostate problems and allergic – The effect of bee pollen are related prostate problems and allergic, to used prevent allergic, the anti allergic activity of bee pollen phenolic extract and the flavonoid my cetin was tested in murin model of ovalbumin induced allergy.
- ✓ Antioxidant activities of bee pollen – That oxidative damage caused by free radical have been implicated in quite a number of disease processes and is the primary factor is aging, antioxidant are capable of providing protection, sometimes significant protection against this oxidative damage. bee pollen appears to provide significant antioxidant

activity, which may explain its traditional uses as an anti aging foods.

### C. Health benefits

The effect and benefits derived from pollen consumption, according to some of non specific literature on the subject are endless; many people report improvement of sometimes chronic problems, it is complete protein, rich in vitamin, minerals, enzyme, amino acid and anti oxidant, is consider an immune system builder that will also enhance vitality, bee pollen is great brain booster lifting brain fatigue and improving alertness and helping concentration levels over an extended periods of time.





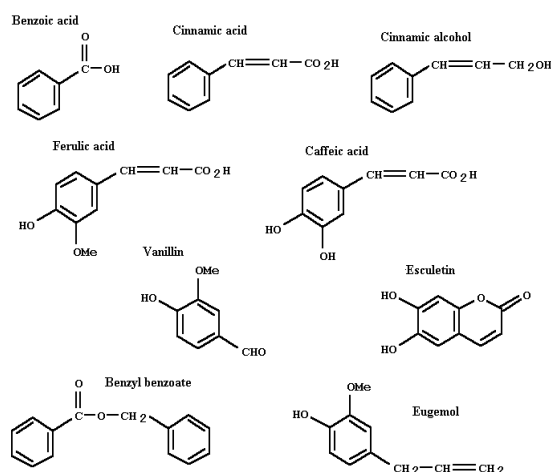
### PROPOLIS:

Propolis is also known as the bee glue which is a generic name that refer to the resinous substance accumulated by bee from Greek to mean defense for pro and city or community for polis, the function is sealing holes and crack the reconstruction of the bee hive, it is also used for smoothing the inner surface of bee hive that retaining the hives internal temperature and preventing weathering and invasion by predators.

#### A. Chemical Composition

It is composed of mainly resin- 50%, wax-30%, essential oils- 10%, pollen- 5%, and other organic compounds- 5%. And also contain vitamins, B1, B2, and B6, minerals, magnesium, calcium, potassium, sodium, copper, zinc, magnesium and iron.

Some phenolic substances in propolis



#### B. Biological activity

##### ✓ Antioxidant activity

It is well known that endogenous stimuli, like cellular metabolism and exogenous agents like UV, toxin and drugs among others that generate reactive oxygen species such as  $H_2O_2$  the superoxide anion and hydroxyl ion as well as reactive nitrogen species, the

chemical varieties in different region have an influence on the antioxidant activity.

##### ✓ Anti inflammatory activity

Inflammation is an event that normally occurs in response to the constant exposure to environmental and endogenous stimuli as well as to accidental damage, a complex cascade of chemical signal



initiates after tissues injury and maintain a host response to repair the injured tissues, anti inflammatory activity mechanism investigate with propolis and its chemical constituent, the role of flavonoids quercetin and flavones in modulating inflammatory cell function was studied.

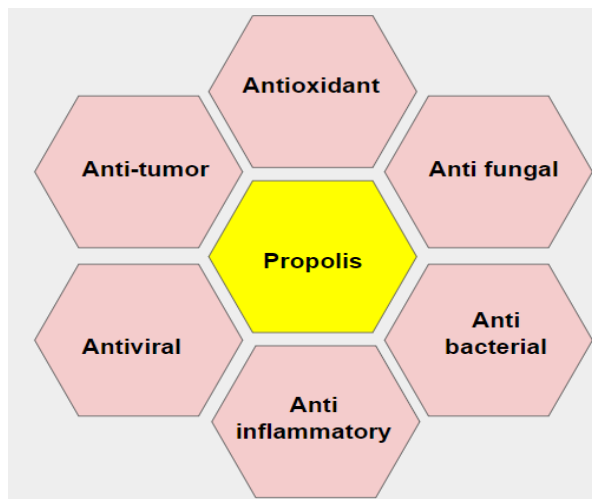
✓ Immunomodulatory activity

Natural substance are consider alternative adjuvant therapy in the treatment of different disease due to their immune modulators effect the action of propolis does not occur only at the macrophage levels, some

studies shown that this action has also an effect on lymphocyte proliferation.

✓ Antiviral activity

Propolis comprise a complexity of the compound which play an important role in antiviral protection, the data available regarding this activity it was shown that propolis from different geographic regions has considerable antiviral activity by acting at different levels and interfering with the replication of some viruses.



C. Health Benefits

• GI Disorders.

These can be cured by using Propolis as it is an antiviral, anti-inflammatory agent. GI tract include abdominal pain, diarrhea, bloating, and nausea can be cured with this.

• Gynecological Care.

The depletion of *Lactobacillus spp.* in the vagina is a distinguished feature of vaginal infections. The infection is accompanied by an overgrowth of vaginal pathogens such as yeast-like fungi and an elevated

vaginal pH. Diabetes patients are more prone to having vaginal infections caused by *Candida albicans*. A study conducted on the application of 5% aqueous propolis solution resulted in an improvement in vaginal well-being.

• Oncological Treatment.

A study reported that propolis has potential towards human breast cancer treatment due to its antitumor activity by inducing apoptosis on human breast cancer cells. It can also be useful in other types of oncological treatments.



### CONCLUSION:

Products of honeybee keeping are honey, wax, pollen, propolis, royal jelly and bee venom which have marketable and economic benefits, the demanding of bee keeping products in the worlds in general on growing tremendously high due to the importance of its as inclusion in cosmetic preparation as natural food, medicinal use and to other values. These products are highly rich inactive components such as flavonoids, phenolic acid, terpenes which have biological function in preventing some disease and promoting good health.

The honeybee venom for treatment of HIV and other ailments has been used safely by recently new area of research and it can be used various treatment of particular disease.

Different microbiological and clinical test, these honeybee product offers many advantage in controlling bacterial growth and in the treatment of certain health problems, and this can be uses honey for particular treatment of wounds has desirable feature like absence of antibiotic resistance as found with conventional antibiotic, the lack of side effects in alleviating gastric pain.

Modern technologies and new research methods that help to the different area should be extended to farmer for better economic benefits.

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