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MEDICINAL BEEKEEPING FOR BEEKEEPERS

Module 4. BEE POLLEN AND BEE BREAD



2021-1-TR01-KA220-VET-000034632

Module subjects

Bee pollen and bee bread - definition

General description of bee pollen and bee bread

Physical and chemical characteristics of bee pollen and bee bread

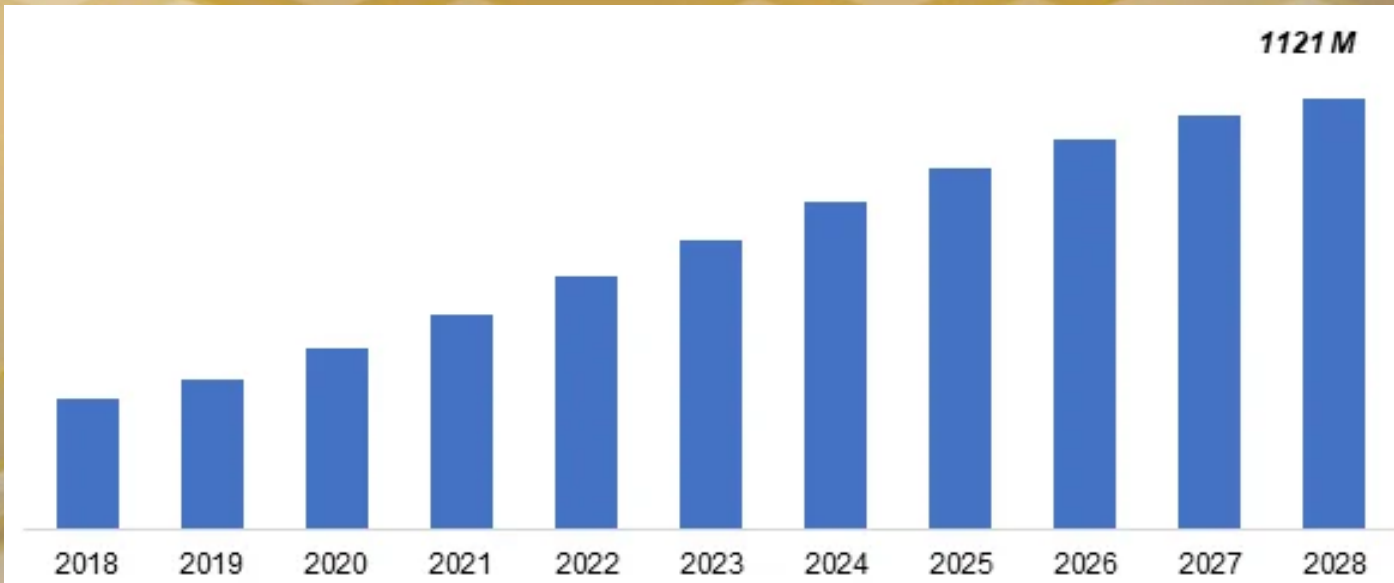
Pro-healthy properties of bee pollen and bee bread

Bee pollen and bee bread harvesting, preservation, processing and storage

Learning outcomes

Knowledge (knows and understands)	Skills (is able to)	Social competencies (is ready to)
<ul style="list-style-type: none"> definition and characteristic of bee pollen and bee bread 	<ul style="list-style-type: none"> list the physical, chemical, and pro-healthy properties of bee pollen and bee bread 	<ul style="list-style-type: none"> take responsibility for bee pollen and bee bread and products based on bee pollen and bee bread production and their quality
<ul style="list-style-type: none"> physical, chemical, and pro-healthy properties of bee pollen and bee bread 	<ul style="list-style-type: none"> indicate and compares various methods of harvesting, preservation, and processing of bee pollen and bee bread 	<ul style="list-style-type: none"> conducting in accordance with the regulations that apply to the performance of bee pollen and bee bread harvesting, preserving, processing, and storage
<ul style="list-style-type: none"> the methods of harvesting, preparation, processing and storage of bee pollen and bee bread 		<ul style="list-style-type: none"> comply with the requirements resulting from technology and the principles of beekeeper work organization
		<ul style="list-style-type: none"> reliable information on bee pollen and bee bread data
		<ul style="list-style-type: none"> comply with the rules of conduct applicable in professional activities that guarantee the proper quality and safety bee pollen and bee bread

Global Bee Pollen market



Bee pollen market 2019 – 2029 (source: Adroit Market Research, 2021)

Asia Pacific occupies 30.14% of the global Bee Pollen market in 2016.

North America ranks the second in terms of production volume of Bee Pollen worldwide, it consists of 17.27% of the national market in the same year.

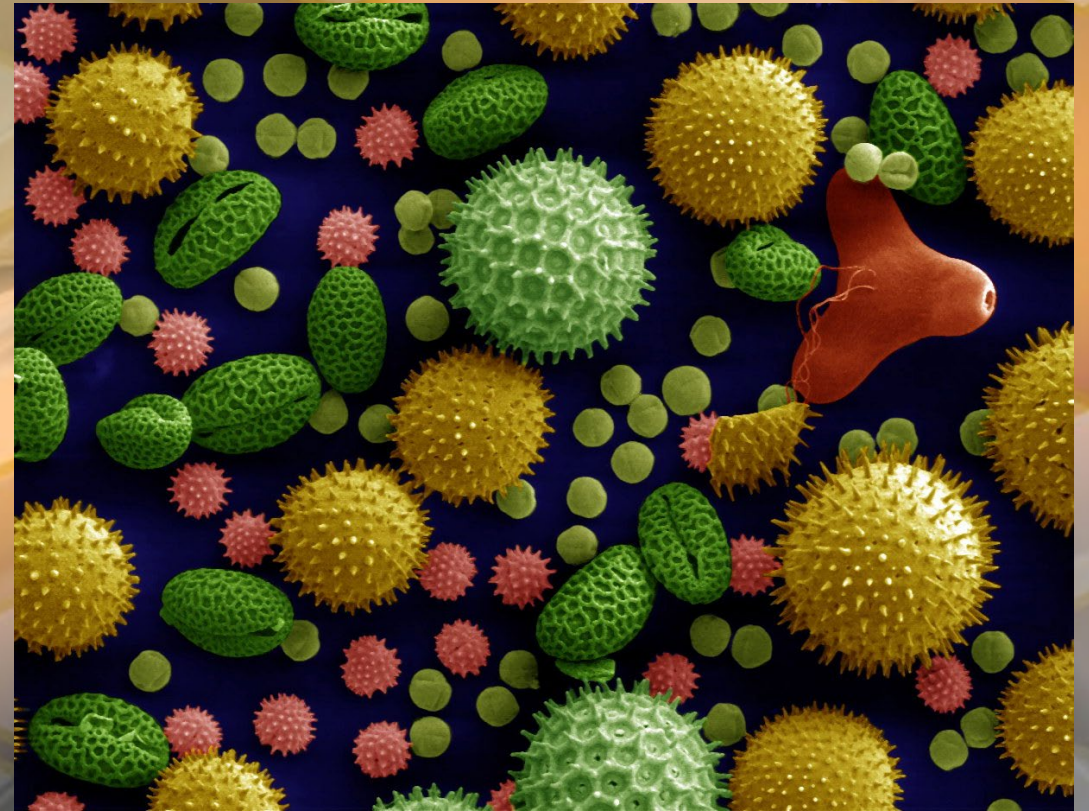
Europe comes the third, with 18.43% of the global market.

All the other regions combined occupies 7.71% of the global Bee Pollen market.

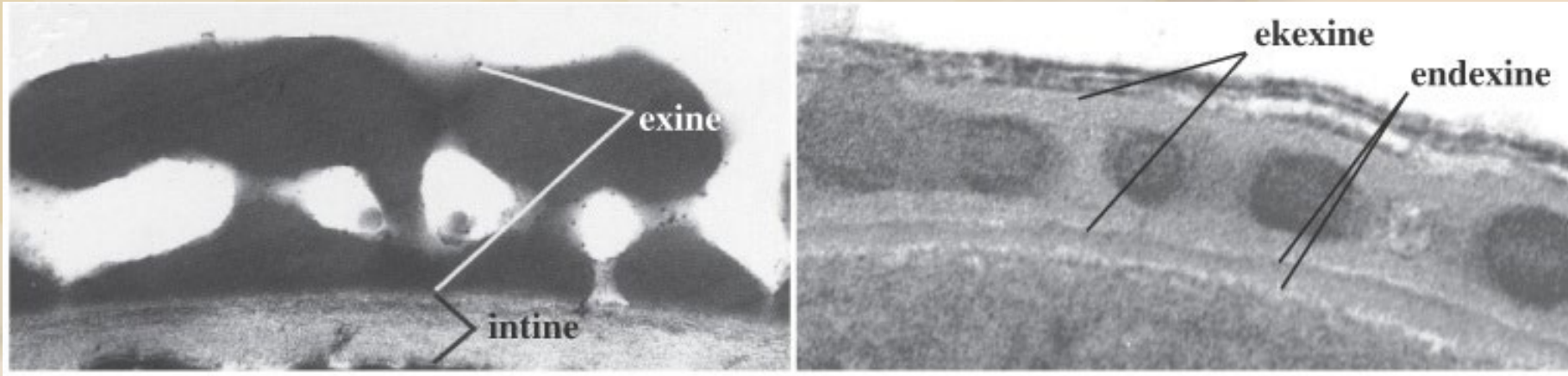
The global Bee Pollen market was valued at USD 579.7 million in 2019 and is expected to reach USD 1121 million, rising at a CAGR of 5.7%.

Pollen. What is it?

- Pollen refers to the reproductive structure of angiosperms, also known as flowering plants, which serves as the male gametophyte.
- Fertilisation is a necessary process for the reproductive success of plants.
- The minuscule particles are composed of corpuscles measuring 50/1,000 millimeters, which are generated at the distal end of the stamen inside the center of the flower.
- Each and every kind of bloom found in the vast expanse of the universe releases a fine layer of pollen particles.
 - Similarly, several orchard fruits and agricultural food crops also have this characteristic.
- The morphology of pollen grains exhibits variations in form, colour, size, and weight, which are contingent upon the specific plant species.
- The grain shapes exhibit a wide range of morphologies, including spherical, cylindrical, bell-shaped, triangular, or thorny forms.



Pollen Wall Structure

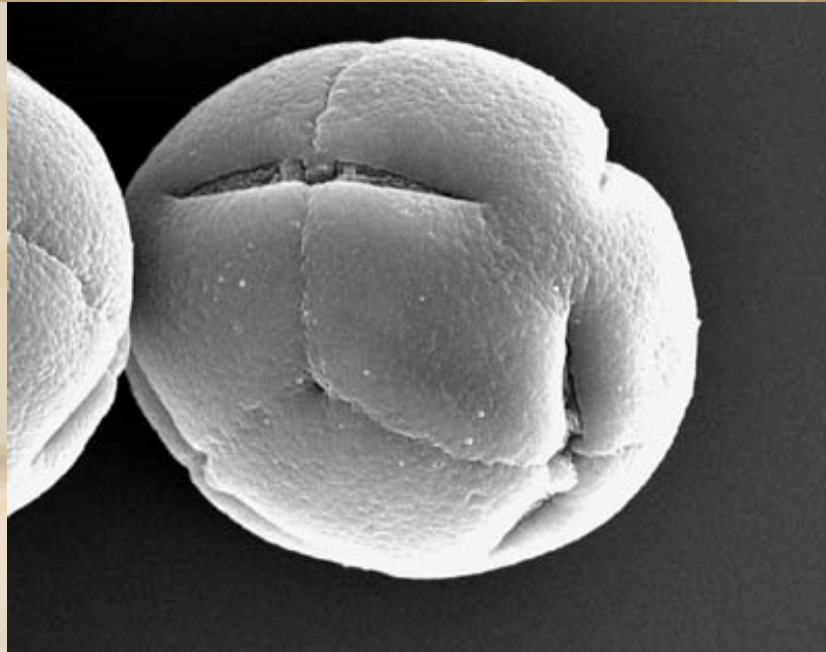


tectate-columellate

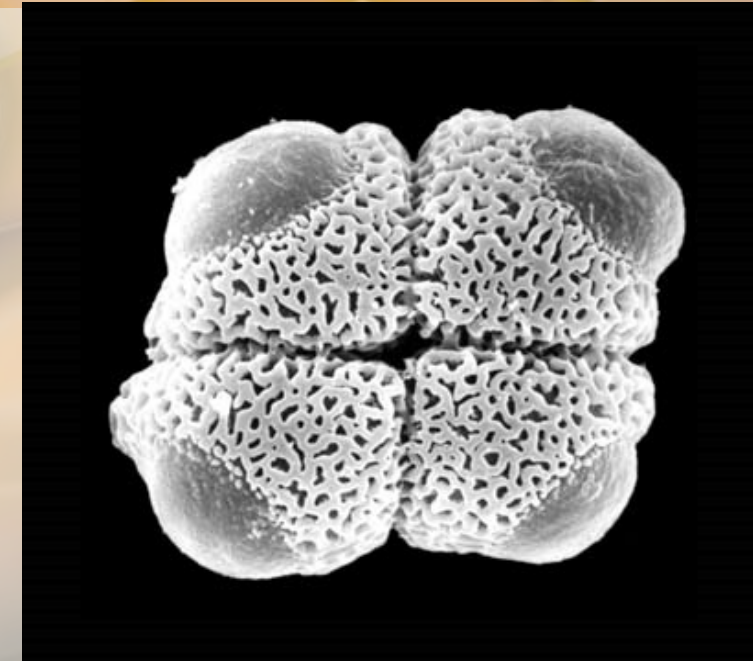
Pollen Unit



monad



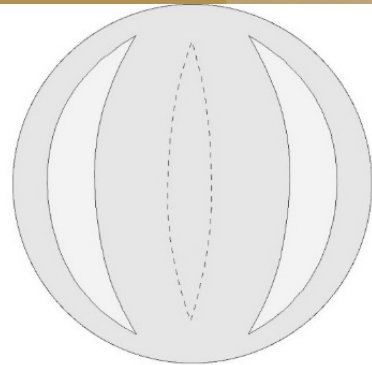
tetrahedral



tetragonal

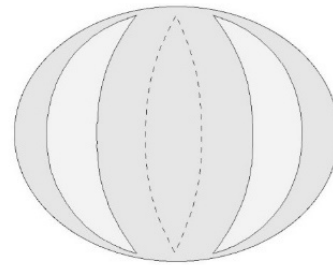
tetrad

Pollen Symmetry, Size, Shape



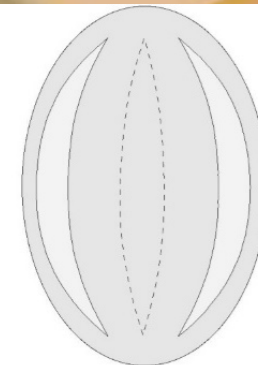
equatorial
view

globose

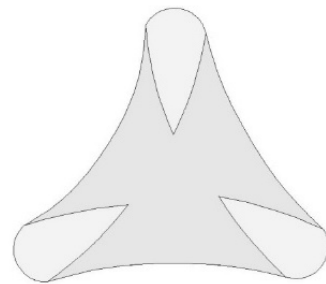


equatorial
view

oblate

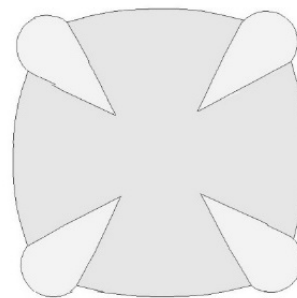


prolate



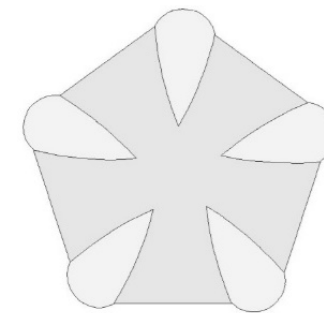
polar view

**3-sided
sides concave**



polar view

**4-sided
sides convex**



**5-sided
sides straight**

Pollen. Composition

Bee pollen refers to little spherical or pellet-shaped clusters of flower pollen that are collected by worker honeybees from natural environments.

- clusters serve as the main source of sustenance for the hive.

The composition of this substance includes simple

- carbohydrates,
- protein,
- minerals and vitamins,
- fatty acids,
- as well as a little proportion of additional constituents.

Pollen. Composition

Bee pollen is collected as a dietary source for human consumption, often accompanied by a range of health assertions.

- Among these assertions is the notion that the fermentation process enhances its potency relative to unprocessed flower pollen.

Bees engage in the process of gathering pollen from the anthers of plants, afterwards combining it with a little quantity of secretion from their salivary glands or nectar.

- They then proceed to deposit this mixture into designated baskets, known as corbiculae, which are located on the tibia of their hind legs:
 - pollen loads.

Honeybees duty

- Honeybees perform dual functions.
- The bees are equipped with a programmed behaviour that involves the collection of pollen from flowers and subsequent transportation of the gathered pollen back to the hive, where it serves as a vital source of sustenance for the whole colony.
- Nevertheless, of greater significance in relation to human beings, they have the responsibility for the **pollination** of almost 80% of photosynthetic organisms.
- As bees traverse from one flower to another, their compact bodies get heavily covered with tiny pollen particles, resulting in their appearance resembling little yellow tufts.
- Upon reaching the subsequent bloom, a fraction of the viable golden pollen is delivered to the reproductive organ of said blossom, so facilitating the process of pollination.

Gathering pollen

Bees – are the most important group of flower pollinators

They live on the nectar and feed larvae, also eat the pollen.

Bees are guided by sight and smell

See **yellow** and **blue** colors, also ultraviolet light (not red)

Flowers have “honey guides” and bee landing platforms.



Gathering pollen

The task at hand is more challenging than it may first seem.

Upon reaching a flower, a honeybee proceeds to position herself and skillfully removes the loose, powdery pollen from the stamen with her jaws and front legs.

- She then proceeds to wet the pollen by applying a little amount of honey that she had previously collected from the hive.

The legs of the individual in question exhibit an expansion and widening of the tarsal segments, accompanied by a dense arrangement of bristles known as pollen combs.

Gathering pollen

- The bee uses these combs to remove the gold powder from its body and appendages while in mid-flight.
- Using a dexterous pressing motion of her auricle, serving as a tool akin to a hammer, she adeptly compacts the accumulated gold into her receptacles.
- The pollen baskets, which are encircled by a border of elongated hairs, are anatomical depressions positioned on the external surface of her tibiae.
- Once the bee's pollen baskets have reached their maximum capacity, the tiny particles of golden pollen have been compacted into a solitary grain or granule.

The act of a honey bee collecting pollen



Gathering pollen

A single bee colony produces an annual yield of pollen ranging from one to seven kilogrammes.

On a daily basis, the quantity of pollen gathered from a single colony ranges from 50 to 250 grammes.

Special devices known as **pollen traps** are used to gather pollen baskets as field bees make their way back to their hives.

The bees are required to go through the traps in order to access the hive, resulting in the partial loss of their pollen basket, prompting them to return outside and gather more pollen.

A pollen trap



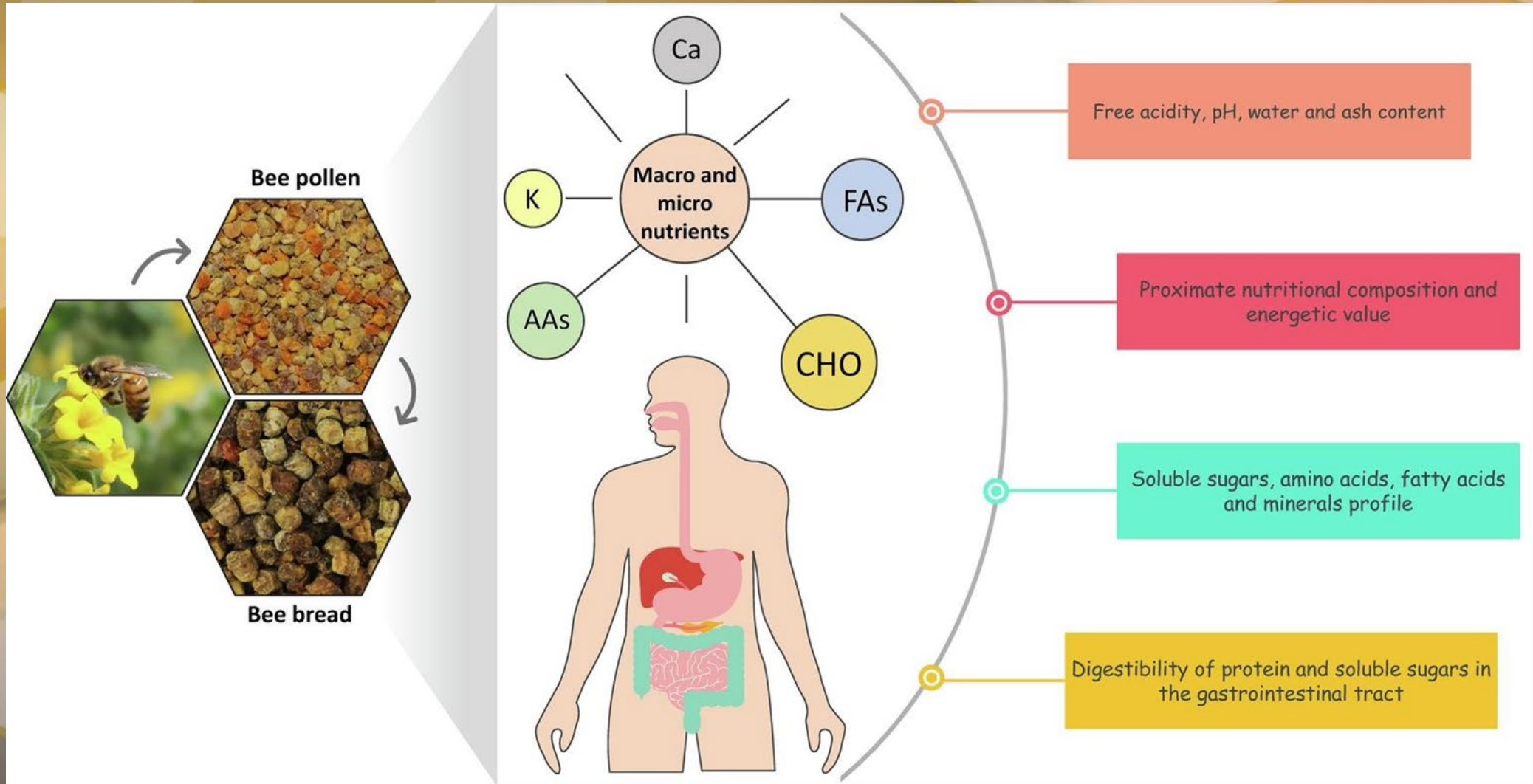
Pollen and bee bread and human nutritional requirements (Kieliszek et. al, 2017)

Component	Bee Pollen	Bee Bread	RDI for 15 g ^b
Proteins	7-40%	14-37%	5-22%
Carbohydrates	24-60%	24-34%	1-4.6%
Lactic acid	0.56%	3.2%	-
Lipids	1-18%	6-13%	0.1-4%
Cellulose	3.7%	2.7%	-
Flavonoids	0.2-2.5%	nd ^a	0.03%
Vitamin	0.02-0.7%	nd	2-70%
Nucleic acid	0.6-4.8%	nd	-
pH	3.8-6.3	4.3	-

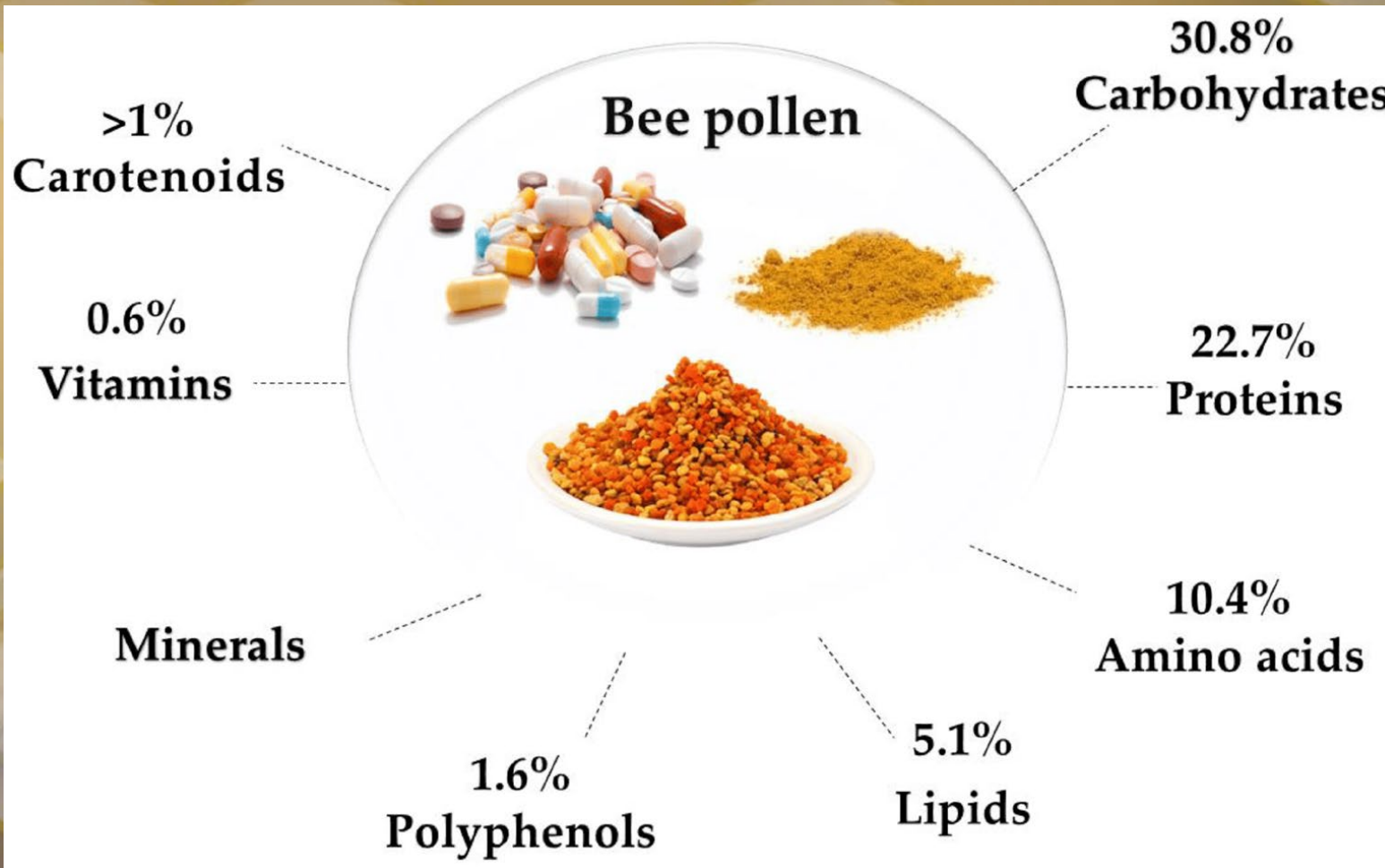
^a - no data.

^b - Campos et al., 2010; Required Daily Intake requirements are according to Reports of the Scientific Committee for Food, 2010. Average RDI values have been assumed.

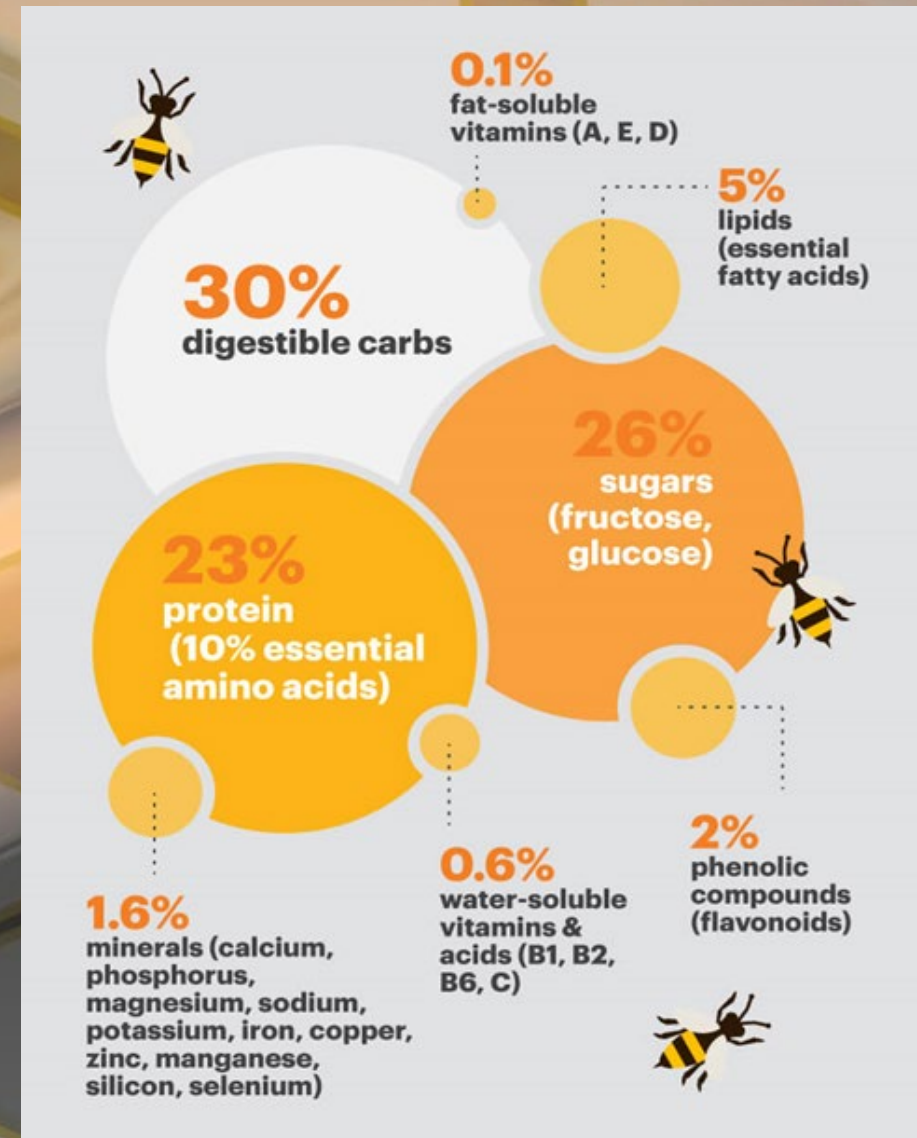
The benefites of bee pollen and bee bread



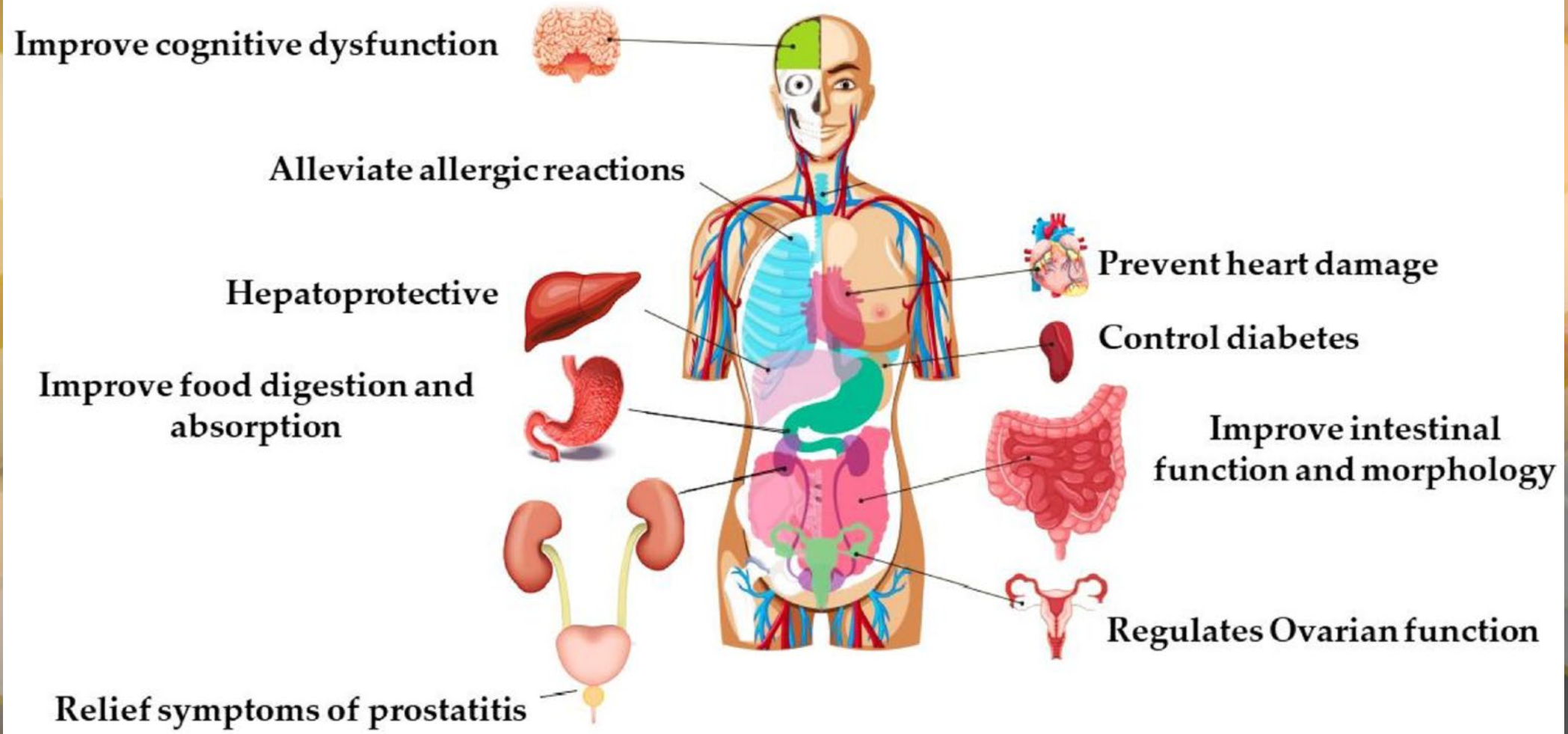
Different components of bee pollen



Khalifa et al., 2021)



Bee pollen improves different functions of the human body



Bee Pollen Benefits



Frozen bee pollen, a human food supplement

From a medicinal standpoint, it exhibits properties that are anti-fungal, antiviral, antibiotic, antiallergic, antimicrobial, anti-inflammatory, hepatoprotective, anticancer, immuno-stimulating, acts as a local anaesthetic, and modifies the process of burn wound healing:

The intervention has anti-inflammatory properties.

Functions as an Antioxidant Safeguards Against Hepatic Toxicity

Enhances the Functioning of the Immune System

Functions as a dietary supplement Alleviates symptoms associated with menopause

Assists in Alleviating Stress Facilitates the Process of Healing

Administration Methods and Dosing



1-7 KG
Amount of pollen one bee colony gives a year

50-250 g
Amount of pollen collected from one colony daily

250
Number of substances in the composition of bee pollen

1:1
1:4

Ratio of ground pollen to honey, cottage cheese or yogurt in a mix

3X
To combat a nutrient deficiency, allergies, inflammation, stress or illness, take 1 tsp of mixed pollen 3 times a day

30-60
Number of days it's safe to take bee pollen by mouth

2-3 POLLEN GRAINS
or granules can be added to warm water for 2-3 hour to release their nutritional value



Bee Pollen Side Effects

- Get emergency medical help if you have any of these signs of an allergic reaction:
 - hives,
 - itching;
 - feeling light-headed;
 - difficult breathing;
 - swelling of your face, lips, tongue, or throat.
- Although not all side effects are known, bee pollen is thought to be possibly safe when taken for up to 30 days.
- Long-term use of bee pollen may cause serious side effects.
- Stop using bee pollen and call your healthcare provider at once if you have:
 - skin rash, bruising, severe tingling, numbness, pain, muscle weakness;
 - trouble breathing;
 - upper stomach pain, loss of appetite; or
 - swelling, rapid weight gain.
- Common side effects may include:
 - numbness, tingling; or
 - upset stomach.

Bee Pollen Side Effects

- If an individual experiences any of the following symptoms, it is imperative to seek immediate medical assistance as it may indicate the presence of an allergic reaction:
 - the appearance of hives,
 - sensations of itching,
 - a sense of lightheadedness,
 - difficulty in breathing, or
 - the swelling of the face, lips, tongue, or neck.
- While the whole range of adverse effects remains uncertain, there is a belief that bee pollen may be considered quite safe for consumption during a 30-day period.
- The prolonged use of bee pollen may give rise to significant adverse reactions.

Bee Pollen Side Effects

- Cease the utilisation of bee pollen and promptly contact your healthcare practitioner in the event that you experience any of the following symptoms:
 - dermatological rash, ecchymosis, intense tingling, numbness, pain, or muscular weakness;
 - respiratory difficulties;
 - discomfort in the upper abdominal region, diminished appetite;
 - or edema accompanied by fast weight gain.
- Frequently seen adverse effects may include sensations of numbness and tingling, as well as gastrointestinal discomfort.

Bee bread

- Bee bread, also known as ambrosia, is a distinctive substance that has significant value for both people and bees alike.
- Acquiring it may be challenging, and its cost is far more than that of honey.
- The primary constituents of bee bread consist of:
 - pollen,
 - honey,
 - and secretions derived from the salivary glands of bees.



Bee bread and bee pollen (source: albeena.co.uk)

Bee bread

- Bee bread is a bee-derived substance that can be described as a "alchemical" creation.
 - It typically consists of:
 - approximately 25% honey or nectar,
 - 70% pollen,
 - and bee saliva.
 - serves to introduce a diverse array of natural probiotic bacteria and yeasts into the pollen.
- These microorganisms play a crucial role in initiating the processes of fermentation and predigestion, which are essential for the transformation of bee bread.
- The bees inside the hive effectively compact the pollen into the cells of the comb, integrating it with other components.
- Following a span of many weeks, a significant transformation has occurred.
 - The production of bee bread has been completed.

Pollen packed in the comb cells



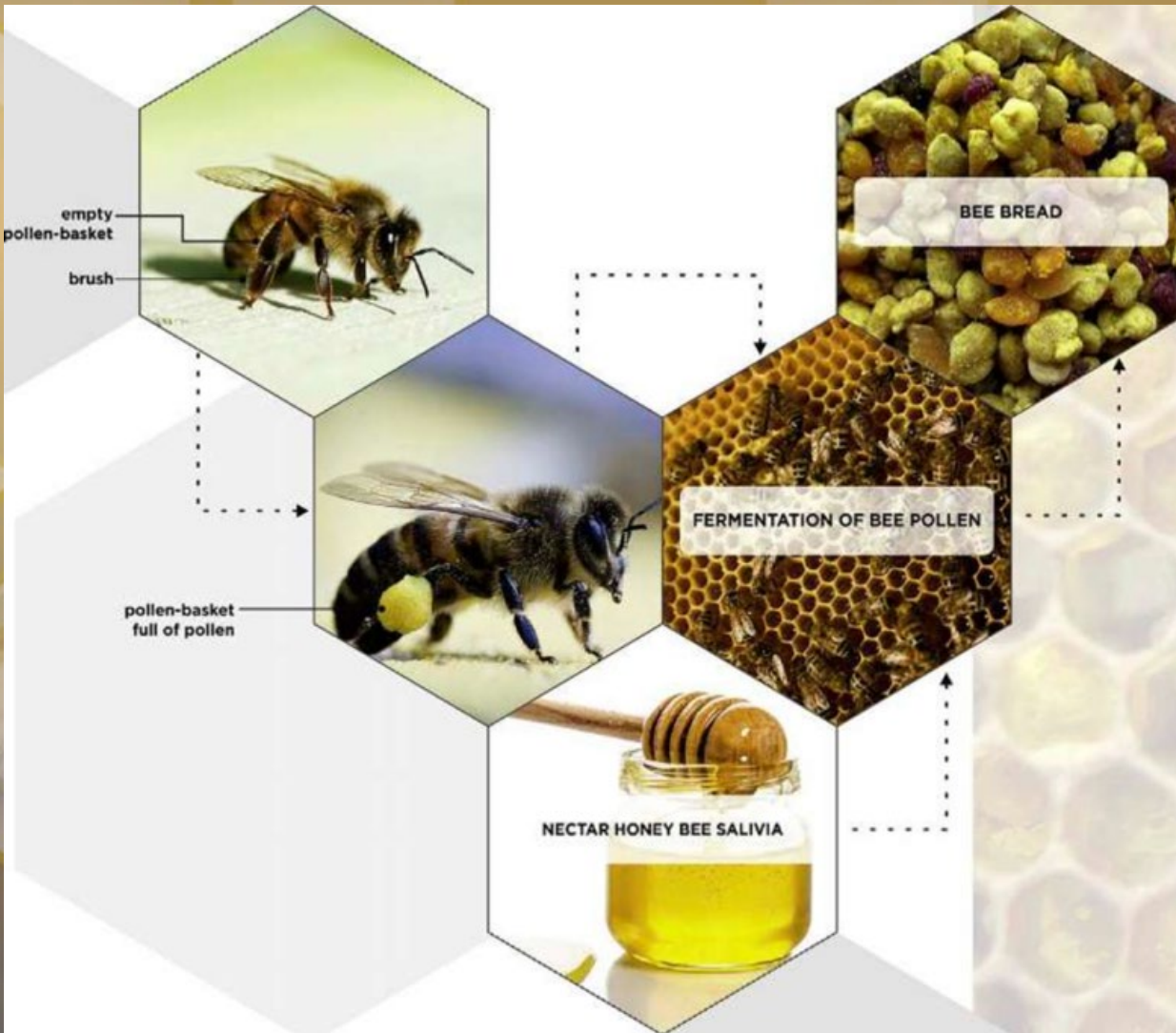
So how does Bee Pollen compare to Bee Bread?

- The protein is perhaps the most significant alteration.
- In addition to the enhancement of protein quality, namely the major improvement in protein bioavailability, there has been a notable development in the predigestion of several proteins into their component amino acids, hence facilitating absorption to a great extent.

So how does Bee Pollen compare to Bee Bread?

- Both the concentrations of
 - antioxidants and the levels of enzymesare greatly increased.
- A significant fraction of the nutritional reserves contained within pollen are now abundantly accessible, particularly in the case of minerals such as:
 - zinc,
 - magnesium,
 - and silica.
- These minerals are often securely bonded inside the cellulose component of pollen.

The process of making a bee bread (Kieliszek et al., 2017)



Bee Bread properties

Bee bread is a very nutritious and energetically dense dietary substance.

The lactic acid produced by probiotic bacteria undergoes conversion into glucose inside the human body.

The use of bee bread significantly extends the longevity of pollen.

Fresh pollen has an exceptionally short lifetime, and its viability rapidly diminishes in the absence of appropriate storage conditions, such as freezing.

The bees have developed a mechanism to extend the longevity of pollen for an extended period, exceeding one year, by producing a substance known as bee bread.

Future projects

- Each bee product is pharmacologically active and may, therefore, be the source of many active substances.
- Of particular importance are the new products derived from bee products with specified pharmacokinetics and pharmacodynamics, which may be the basis for many new forms of drugs or dietary supplements.
- In the last few years, natural products like bee bread or pollen can be used as an alternative to antibiotics, as well as to enhance the immune system of humans and animals.
- It was demonstrated that bee pollen acts as an immunomodulator in that it stimulates a humoral immune response and changes the delayed-type hypersensitivity.

Summary

- The study of naturally occurring chemicals, encompassing both long-established and newly found molecules, has experienced a steady increase in interest.
- Bee products are popular due to their many nutritional and therapeutic advantages.
- Although these compounds have been utilised for thousands of years, scientific research on them has only recently garnered little record.
- There has been a significant boom in the market for natural products, with a particular focus on bee-derived things.
- Because of its nutritional and medicinal properties, bee bread and pollen are employed in apitherapeutic applications.

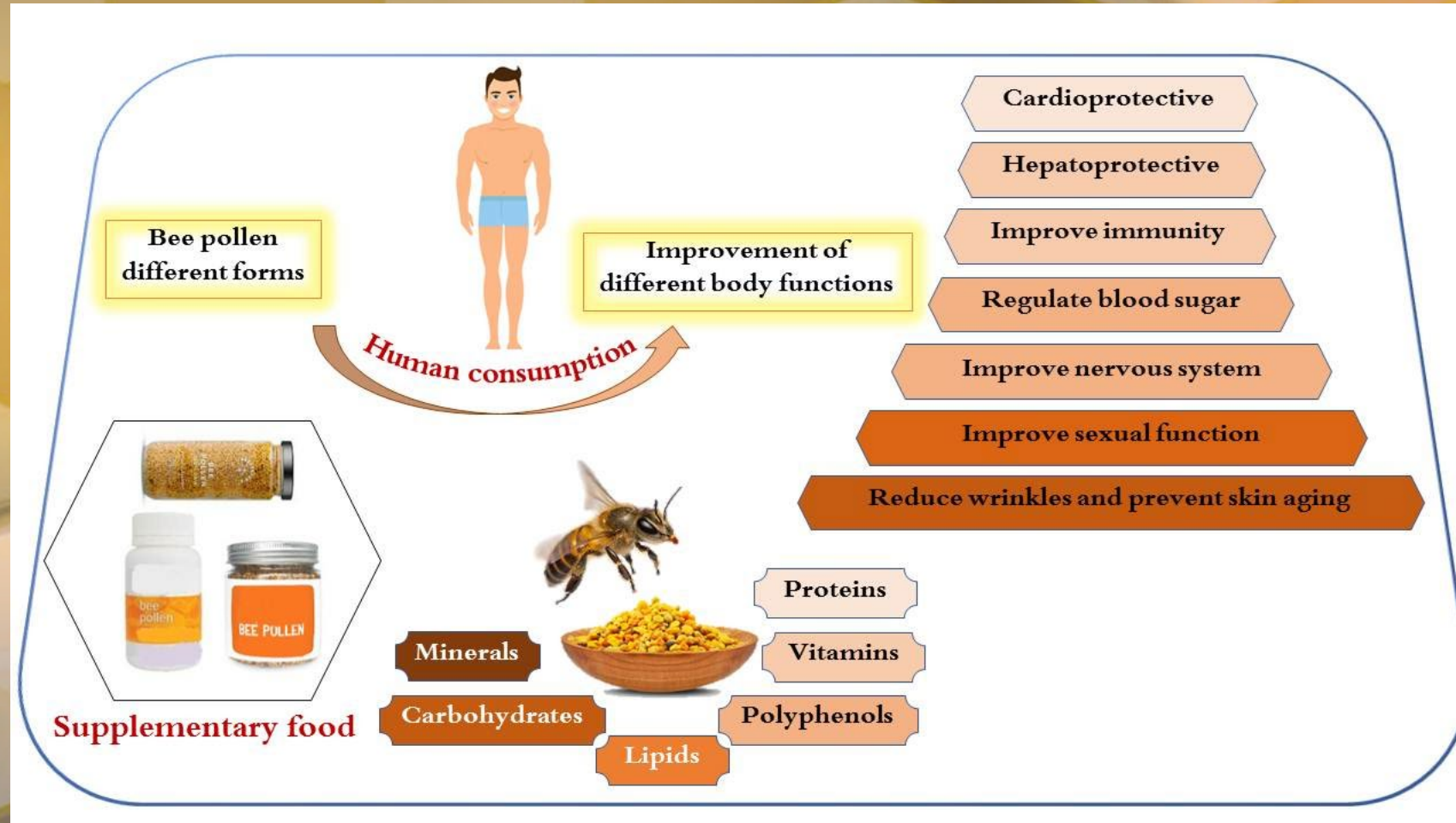
Summary

- Among the components are around 200 different molecules, including but not limited to free amino acids and vitamins.
- Unsaturated fatty acids, such as linoleic, linolenic, and arachidonic acids, found in pollen and bee bread, should be prioritised.
- As a result, bee bread with a high concentration of beneficial ingredients has shown its capacity to satisfy these predicted consequences.
- It is a complete, biologically potent vitamin that may be employed in the food industry.

Summary

- People are moving their attention away from overly processed meals and towards natural foods that have been scientifically shown to have substantial nutritional value.
- Bee bread and pollen include nutrients that the human body can easily absorb.
- As a result, they make it easier to replenish nutritional deficiencies and improve an organism's capacity to adapt to adverse environmental conditions, so improving both physical and mental well-being.
- In conclusion, *products obtained from bees exhibit a broad variety of advantageous biological properties that have the potential to be efficiently used in the sectors of food technology and medicine.*
- *These properties include antimicrobial, antifungal, antibacterial, and antiviral effect.*

Bee Pollen and Bee Bread properties



References

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This presentation was made as part of the European project MEDI-BEEB Medicinal Beekeeping for Beekeepers

To know more about the project, please visit our website
<https://www.medibeebe.eu/>



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