

Royal Jelly



INTRODUCTION

Royal jelly is a fluid secretion produced by worker bees, to feed all the larvae in the hive during their first days of life. Only one bee – selected to become a queen – is fed with royal jelly for the rest of its life. Royal jelly is secreted from glands on the heads of worker bees. It is synthesized from pollen, water and honey, mixed with saliva, hormones and vitamins. Fresh royal jelly tastes acid and resembles condensed milk.

Royal jelly extract is a suspension of royal jelly in glycerin.

CHEMISTRY

The composition of royal jelly includes: 65.3% water and 34.7% dry residue, the later composed of 48.2% proteins, 37.8% carbohydrates, 10.4% lipids and 2% ash (<http://membres.lycos.fr/ecrausaz/Jalea-real.html>).

Proteins

Royal jelly is one of the richest natural products in amino acids. Amino acids are very important for humans and animals. Royal jelly contains at least 17 amino acids, including the 8 essential ones, plus 5 non-identified related compounds. Amino acids are basic for the protection against illnesses, for growth and for tissue reparation and renewal.

Table 1 lists the amino acids in royal jelly proteins. Table 2 lists the free amino acids in royal jelly.

Amino acids	%
Valine	1.6
Glycine	3.0
Isoleucine	1.6
Leucine	3.0
Proline	3.9
Threonine	2.0
Serine	2.9
Methionine	3.7
Phenylalanine	0.5
Aspartic acid	2.8
Glutamic acid	8.3
Tyrosine	4.9
Lysine	2.9
Arginine	3.3
Tryptophan	3.4

Table 1. Amino acid composition of royal jelly proteins (<http://membres.lycos.fr/ecrausaz/Jalea-real.html>).

Free amino acids	%
Alanine	1.7
Valine	1.7
Glycine	2.1
Isoleucine	1.3
Leucine	13.3
Proline	139.8
Threonine	1.0
Serine	3.5
Amino butyric acid	3.5

Table 2. Free amino acids in royal jelly. (<http://membres.lycos.fr/ecrausaz/Jalea-real.html>).

Vitamins

Royal jelly contains the vitamins B1, B2, B6, B5 (large amounts), B8, B9, C and PP. Table 3 shows the vitamins in royal jelly.

Vitamins	mg/100g
Vitamin A	1.10
Vitamin D	0.2
Vitamin E	5.00
Vitamin B1	2.06
Vitamin B2	2.77
Vitamin B6	11.90
Vitamin B12	0.15
Vitamin B5 (Panhotenic acid)	52.80
Niacin (PP)	42.42
Vitamin C (Ascorbic acid)	2.00
Vitamin B9 (Folic acid)	0.40
Inositol	42.00

Table 3. Vitamins in royal jelly.
(<http://membres.lycos.fr/ecrausaz/Jalea-real.html>).

Minerals

Royal jelly is also rich in minerals, especially in potassium, magnesium, calcium, iron, phosphorus, sulfur, manganese, silicon, lead and others.

TRADITIONAL USES

Because of its chemical composition, royal jelly has traditionally been used as a dietary supplement to treat weakness and physical or psychical exhaustion.

Royal jelly is considered an elixir of youth since the ancient times, because it provides vitality to the body. In cosmetics, royal jelly is the flagship ingredient in the anti-aging products of a number of companies.

COSMETIC PROPERTIES

Skin regeneration

Royal jelly is a renown ingredient of cosmetic creams, because it provides a younger and clearer appearance to the skin. Royal jelly is a natural product with high contents of nutrients for the skin. It enhances the skin metabolism and delays skin aging. This property is due to the following components:

- Proline; this amino acids promotes the synthesis of collagen and elastin, two key components in the conjunctive tissue.
- Aspartic acid: one of the most abundant amino acids in royal jelly. This amino acid is essential for skin regeneration and tissue growth.
- Vitamins of the B group
They contribute to skin health and cell renewal processes.
Vitamin B2 (riboflavin): essential to maintain the integrity of mucosa membranes. B2 deficiency produces skin ulcers. It is involved in oxygen transportation to the tissues.
Vitamin B8 (biotin): B8 deficiency produces scaling lesions on the skin and the mucosa membranes.
Vitamin B9 (folic acid): involved in cell renewal
Vitamin B6 (pyridoxine): plays a role in zinc metabolism; this mineral is part of the epidermis.
- Vitamin C: involved in collagen synthesis.

Therefore, royal jelly extract is recommended to formulate cosmetic products with stimulatory activity on cell metabolism, epithelization and tissue regeneration.

Skin conditioning activity

This activity is due to the protein, carbohydrates and vitamins in royal jelly.

- **Proteins**

The polar nature of proteins gives them the capacity to bind water molecules by establishing hydrogen bonds. This action is not influenced by the molecular weight of the protein. However, if penetration into the skin and moisturizing in deeper skin layers is the goal, then short-chain, low molecular weight peptides yield better results.

Thus, low molecular weight proteins are good moisturizing agents for deep skin layers, while high molecular weight proteins – due to their filmogenic action – are better for surface moisturizing and for giving the skin firmness and smoothness.

- **Carbohydrates**

Carbohydrates are active principles extensively used in cosmetics. These compounds are hygroscopic, namely they adsorb water thus contributing to keep a healthy moisture level in the horny layer. These active compounds build hydrogen bonds, thus preventing massive water loss and reducing dehydration. Additionally, some of these compounds make a protective coat on the skin, thus preventing and slowing down transepidermal water loss.

Therefore, royal jelly extract is recommended to formulate cosmetic products with moisturizing, smoothing and general conditioning effects on the skin.

Antioxidant activity

Royal jelly includes vitamins B5 and C both with antioxidant properties.

- Vitamin B5 (panthotenic acid): royal jelly is the richest natural source of vitamin B5. This vitamin acts as an antioxidant, reduces irritation, promotes wound healing and helps maintaining dermal balance.
- Vitamin C (ascorbic acid): protects the skin from the deleterious oxidative action of free radicals.

Therefore, royal jelly extract is recommended to formulate cosmetic products aimed at the protection of skin and hair integrity against oxidative processes.

Antimicrobial activity

Recent research has demonstrated innate or immediate immunity in the vegetal as well as in the animal kingdom. Antimicrobial peptides (AMP) are elements of innate immunity that play an essential role in the fight against infections. In general, AMP are low molecular weight peptides (usually less than 10 kDa), which are coded in the genome (differently from other antimicrobial agents, which are produced by enzymatic action, e.g. penicillin). AMPs are amphipathic compounds – stable in aqueous and hydrophobic environments – mainly synthesized in epithelial tissues, which are regularly exposed to microbial attacks, such like skin, intestines and lungs. Up to date, about 500 AMPs from different organisms including humans, plants, invertebrates, amphibians, fishes and microorganisms, have been described (Montaño Pérez K & Vargas Albores F, 2002).

AMPs produce their antimicrobial action through one of the following action mechanisms: a) by impairing the synthesis of metabolic enzymes or DNA, e.g. some microbial AMPs, which are not completely understood; b) directly on the cell membrane, by altering its permeability or by making canals or pores, e.g. α -helix peptides (Montaño Pérez K & Vargas Albores F, 2002).

Table 4 shows the main AMPs identified in insects.

AMP	Type	Activity
Cecropin	α -helix	Gram (-) bacteria
Several defensins	Defensin	Gram (+) bacteria
Apidaecin	High proline content	Gram (+) bacteria
Royalisin	High proline content	Gram (-) bacteria
Attacins	High glycine content	Synergistic
Drosomycin	Defensin	Fungicide

Table 4. Main AMPs identified in insects (Montaño Pérez K & Vargas Albores F, 2002).

The following peptides have been identified in honeybees (*Apis mellifera*): apidaecin, abaecin and royalisin. These AMPs are effective against Gram (-) bacteria; they have a typically high proline content (Montaño Pérez K & Vargas Albores F, 2002).

Therefore, royal jelly extract is of great use to formulate cosmetic products with purifying and antiseptic activity.

Anti-inflammatory activity

Kohno K et al (2004) examined the anti-inflammatory actions of royal jelly at a cytokine level. When supernatants of royal jelly suspensions were added to a culture of mouse peritoneal macrophages stimulated with lipopolysaccharide and IFN- γ , the production of proinflammatory cytokines, such as TNF- α , IL-6, and IL-1, was efficiently inhibited in a dose-dependent manner without having cytotoxic effects on macrophages. This suggests that royal jelly contains factors responsible for the suppression of proinflammatory cytokine secretion. The authors named these factors "honeybees royal jelly-derived anti-inflammatory factor (HBRJ-AIF)". Thus, these results suggest that royal jelly has anti-inflammatory actions through inhibiting proinflammatory cytokine production by activated macrophages.

Therefore, royal jelly extract is recommended to formulate cosmetic products with anti-irritant activity.

Regulatory activity on sebum secretion

Royal jelly contains vitamin B2 and sulfur, both with anti-seborrhea activity.

- Vitamin B2 deficiency results in skin and mucosa lesions and seborrheic dermatitis.
- Sulfur: this mineral is currently used to treat seborrhea because of its keratolytic action (Serra-Baldrich E, 1988).

Thus, royal jelly extract is recommendable to formulate cosmetic products aimed at restoring normal sebum secretion.

COSMETIC APPLICATIONS

Action	Active	Cosmetic Application
Skin regeneration	Amino acids Proteins	-Stimulation of cell metabolism -Epithelization -Tissue regeneration
Skin conditioning	Proteins Carbohydrates	-Moisturizing -Soothing
Antioxidant	Vitamins	-Anti-aging -Photoprotector -Hair color protection
Antimicrobial	Proteins	-Purifying -Antiseptic
Anti-inflammatory	HBRJ-AIF	-Anti-irritant
Sebum secretion regulation	Vitamins Sulfur	-Restoring normal sebum secretion

RECOMMENDED DOSE

The recommended dose is between 0.5% and 5.0%.

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