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# Bee Pollen – Physical and Chemical Properties

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Innumerable stories and even more rumours exist about the mysterious powers of pollen and its nutritional value. Pollen is frequently called the "only perfectly complete food". High performance athletes are quoted as eating pollen, suggesting their performance is due to this "miracle food", just as the "busy bee" represents a role model for an active and productive member of society. Using suggestive names, labels and descriptions in marketing of various products containing pollen sometimes reach almost fraudulent dimensions, creating false hopes and expectations in people, often connected with high prices of the product. Such practices are untruthful, unethical and should be avoided.

It is however, often difficult for a lay person to verify the numerous claims, particularly those backed up with so-called reports from "doctors". Conversely, it does not always take a "scientific" study to prove that a food (or substance of herbal origin) has a medicinal or otherwise beneficial effect. Many times, modern science is not willing or able to prove beneficial effects according to its own rigid standards, methods and technologies. However, as a whole, caution should be exercised in accepting the many claims made to the credit of pollen and for that matter also for the other products incorporating products from the bee hive.

Pollen grains are small, male reproduction units (gametophytes) formed in the anthers of the higher flowering plants. The pollen is transferred onto the stigma of a flower (a process called pollination) by either wind, water or various animals (mostly insects), among which bees (almost 30,000 different species) are the most important ones.

Each pollen grain carries a variety of nutrients and upon arrival at the stigma it divides into several cells and grows a tube through the often very long stigma of the flower. Growth continues to the embryo sac in the ovarium of the flower, inside which one egg cell will fuse with a sperm cell from the pollen and complete the fertilization. Depending on the requirements for this process and the mode of transport from one flower to the next, i.e. insects, water or wind, each species of plants has evolved a characteristic pollen type. Thus, the pollen grains from most species can be distinguished by their outer form and/or by their chemical composition or content of nutrients. The knowledge of this is used in the identification of paleontological discoveries (paleopalynology) and in the identification of geographic and botanical origin of honeys (melissopalynology).

To determine the value of pollen as a supplementary food or medicine, it is important to know that pollen from each species is different and no one pollen type can contain all the characteristics ascribed to "pollen" in general. Therefore, in this text, pollen will always refer to a mixture of pollen from different species, unless otherwise mentioned. A logical conclusion is that pollen from one country or ecologic habitat is always different from that of another. People who are allergic to pollen will have noticed this during their travels.

Since pollen is a part of these flowers and in addition is or represents the male reproductive portion, it also has very special "energies" or values of its own. In a wider understanding in certain philosophical environments, special plant and pollen surface

structures interact with cosmic energies and may acquire some of their characteristics by this means.

Apart from these less orthodox explanations, certain empirical results have in the past been described for the effects of pollen on humans and animals. These will be discussed under medicinal uses. As far as the miracle food aspect of pollen is concerned, the diversity of pollen must be emphasized again and the fact that some pollen types (i.e., pine and eucalyptus) are nutritionally insufficient even for the raising of honeybee larvae. Pollen was richer in most ingredients when compared on a weight or calorie content basis than such foods as beef, fried chicken, baked beans, whole wheat bread, apple, raw cabbage and tomatoes. While comparable in protein and mineral content with beef and beans, Pollen averages more than ten times the thiamin and riboflavin or several times the niacin content. Pollen is usually consumed in such small quantities that the daily requirements of vitamins, proteins and minerals cannot be taken up through the consumption of pollen alone. However, it can be a substantial source of essential nutrients where dietary uptake is chronically insufficient.

If the nutritional benefit of pollen in small dosages is accepted, as described in many non-scientific publications, it must be understood as a synergistic effect. That is, a wide variety of beneficial substances interact to improve absorbtion or use of the nutrients made available to the body from regular nutrition. Pollen nutrients may also balance some deficiencies from otherwise incomplete or unbalanced supplies, absorption or usage.

The pollen which is collected by beekeepers and used in various food or medicinal preparations is no longer exactly the same as the fine, powdery pollen from flowers. The hundreds or sometimes millions of pollen grains per flower are collected by the honeybees and packed into pollen pellets on their hind legs with the help of special combs and hairs. During a pollen collecting trip, one honeybee can only carry two of these pollen pellets.

The pollen collected by honeybees is usually mixed with nectar or regurgitated honey in order to make it stick together and adhere to their hind legs. The resulting pollen pellets harvested from a bee colony are therefore usually sweet in taste. Certain pollen types however, are very rich in oils and stick together without nectar or honey. A foraging honeybee rarely collects both pollen and nectar from more than one species of flowers during one trip. Thus the resulting pollen pellet on its hind leg contains only one or very few pollen species. Accordingly, the pollen pellet has a typical colour, most frequently yellow, but red, purple, green, orange and a variety of other colours occur.

The partially fermented pollen mixture stored in the honeybee combs, also referred to as "beebread" has a different composition and nutritional value than the field collected pollen pellets and is the food given to honeybee larvae and eaten by young worker bees to produce royal jelly. Saying pollen is the perfect food because it is the only food source for honeybees other than honey, their major carbohydrate source is not only based on a questionable comparison between human needs and bee requirements, but also on plain misinformation.

## Physical characteristics of pollen

Pollen grains range from 6 to 200 m in diameter, and all kinds of colours, shapes and surface structures may be observed. These are usually typical enough to allow species or at least genus identification. Most pollen grains have a very hard outer shell (sporoderm) which is very difficult or impossible to digest. It is so durable that it can be found in fossil deposits millions of years old. There are, however, pores which allow germination and also extraction of the interior substances.

## The composition of pollen

Since the composition of pollen changes from species to species, variation in absolute amounts of the different compounds can be very high. Protein contents of above 40% have been reported, but the typical range is 7.5 to 35%: typical sugar content ranges from 15 to 50% and starch content is very high (up to 18%) in some wind-pollinated grasses.

Composition of pollen and bee-collected pollen however, has to be distinguished. Some average values for bee-collected pollen.

The major components are proteins and amino acid, lipids (fats, oils or their derivatives) and sugars. The minor components are more diverse. All amino acids essential to humans (phenylalanine, leucine, valine, isoleucine, arginine, histidine, lysine, methionine, threonine and tryptophan) can be found in pollen and most others as well, with proline being the most abundant. Many enzymes (proteins) are also present but some, like glucose oxidase which is very important in honey. have been added by the bees. This enzyme is therefore more abundant in "beebread" than in fresh pollen pellets.

## The average composition of dried pollen

| Parameter | Bee-collected | | Hand-collected |
|---|---|---|---|
| | %[a] | %[b] | %[b] |
| Water (air-dried-pollen) | 7 | 11 | 10 |
| Crude protein | 20 | 21 | 20 |
| Ash | 3 | 3 | 4 |
| Ether extracts (crude fat) | 5 | 5 | 5 |
| Carbohydrate | | | |
| Reducing sugars | 36 | 26 | 3 |
| Non-reducing sugars | 1 | 3 | 8 |
| Starch | - | 3 | 8 |
| Undetermined | 28 | 29 | 43 |