

# Macro and Micro Mineral Elements Composition of Bee Pollen from Rainforest Zone of Nigeria

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**Abstract:** Bee pollen is the male seed of a flower blossom which has been gathered by the bees and to which special elements from the bees has been added. Laboratory analysis was carried out on the macro and micro mineral element compositions of bee pollen from *Apis mellifera adansonii* and *Melipona* species obtained within the rainforest zone of Nigeria. Results obtained indicated that the bee pollen types contained the minerals at varying concentrations. The main elements obtained were potassium (K) (91.00) mg/100g and phosphorus (99.15)mg/100g. Some of the trace elements included: iron (Fe), zinc (zn) Etc. However, bee, pollen can serve as a mineral supplement. Also the percentages obtained might be the quantity required by the bees for brood rearing and therefore, should be used in formulating the quantity of minerals to be fed to the brood in the absence of pollen in this region.

**Keywords:** bee, pollen, macro and micro mineral element

## 1. Introduction

Pollen is the male gametophyte of flowers. Collected flower pollen is accumulated as corbicular pellets in pollen baskets on the rear legs of the honey bee and it is a mixture of these pellets that comprises bee pollen [1]. Bee pollen is the male seed of flower blossom which has been gathered by the bees and to which special elements from the bees has been added. The honey bee collects pollen, and mixes it with its own digestive enzymes. Bee pollen is often referred to as nature's most complete food. It rejuvenates your body, stimulates organs and glands, enhances vitality and brings about a longer life span. Bee pollen's ability to consistently and noticeably increase energy levels makes it a favorite substance among many world class athletes and those interested in sustaining and enhancing quality performance. Whilst honey forms the energy source of the bee colony, pollen is the bees main source of the other important nutrients: proteins, minerals, fats and other substances [2,3,4,5,6,7]. Bee pollen is essential for brood rearing. Bee pollen should not be confused with the pollen that is blown by the wind and is a common cause of allergies. Allergy causing pollen is called anemophiles; it is light and easily blown by the wind. Bee pollen is heavier and stickier. It is called entomophiles and will rarely cause allergy symptoms. Bee pollen contains all 22 known amino acids and all 28 minerals found in the human body. However, this analysis aimed at studying the macro and micro mineral compositions of pollen from *Apis mellifera* and *Melipona* species from the rainforest zone of Nigeria, since there is still scanty information on that especially that of the *Melipona* species. The mineral requirement of the brood for development in this region has not been studied. The study of the mineral composition of bee pollen then may be of help in formulating the quantity of minerals to be fed to the brood in the absence of pollen which can assist on improving colony production.

## 2. Materials and Methods

### 2.1 Sample Collection

The samples were collected from bee colonies located within the rainforest zone of Nigeria.

### 2.2 Determination of macro mineral composition of bee pollen

The minerals (calcium, magnesium, potassium, sodium and phosphorus) were determined following the dry ash acid extractor method of [8]. 1.0g of each sample was also by putting it in a pre-weighed crucible and kept on a muffle furnace at 550C for about 3 hours. It was then cooled in a desiccator and weighed. The resulting ash was dissolved in 10mls of 2M HCL solution and made up to 100ml in volumetric flask. The extract was filtered through a Whatman No 42 filter paper and used for the analysis. For phosphorus (p) the spectrophotometer method was used, the flame photometry method was used to determine sodium (Na) and potassium (K) and the complexometric titration method was used for the determination of calcium and magnesium.

### 2.3 Determination of the Micro Elements

These included manganese (Mn), Zinc (Zn), copper (Cu), Lead (Pb), aluminium (Al), Iron (Fe), silicon (Si). The above mentioned minerals were determined using the Atomic absorption spectrophotometer. 5ml of the digest was pipetted into 50ml volumetric flask diluted to 50ml with distilled water. The absorbances of minerals in ppm were read from the solution with Atomic absorption spectrophotometer. Serial dilution of standard solution of the elements were made and read on the atomic absorption spectrophotometer and absorbances got were plotted against the concentration in ppm. A calibration curve was obtained and the concentration of the elements in the digest was obtained via extrapolation of the absorbance from the calibration curve.

### 2.4 Statistical analysis

The macro elements of the two types of bee pollen were compared using test.

## 3. Results and Discussion

**Table 1:** T-test of the macro elements composition of *Apis mellifera* pollen and *Melipona* species pollen  
 Minerals (macro elements) mg/100g

Sample	calcium	magnesium	potassium	sodium	phosphorus
<i>Apis mellifera</i>	13.36	4.40	91.00	10.58	99.15
<i>Melipona</i> sp	13.36	7.20	82.66	11.12	94.83
T-cal	0.000	-1.750	2.229	-20.125	0.261
Sig (2-tailed)	1.000	0.155	0.090	0.000	0.807

The experiment carried out showed macro element composition of bee pollen to include calcium (13.36 and 13.36) mg/100g, magnesium (4.40 and 7.20) mg/100g, potassium (91.00 and 82.66) Mg/100g, sodium (10.58 and 11.12) mg/100g and phosphorus (99.15 and 94.83)mg/100g for *Apis mellifera* and *Melipona* species pollen samples respectively. There was significant difference in their sodium content. No significant difference was obtained in their calcium, magnesium potassium and phosphorus ( $p > 0.05$ ). This must have been that the two species require similar quantities of micro minerals in their pollen. Also, the results obtained may be associated with the floral sources and also the ability of the plants to obtain mineral salts in

their pollen. Phosphorus concentrations in the samples (99.15 and 94.83) mg/100g were the highest compared to other minerals, followed by potassium (91.00 and 82.66) mg/100g and the least obtained was magnesium (4.40 and 7.20) mg/100g. Phosphorus is a vital mineral forming the very matrix of the genetic substances DNA and RNA, which are substances controlled by hereditary. Phosphorus regulates metabolic process that involves phosphorylation which includes absorption of glucose from the intestine and its uptake by the cell. Potassium is necessary for the human body mainly in all tissue cells. It is required for the maintenance of osmotic pressure and fluid balance within the cell. Calcium catalyses the clotting of blood, also it activates several enzymes such as pancreatic lipase. It is vital in regulating contraction and relaxation of muscles.

Also, sodium is the principal electrolyte in the extracellular fluid which maintains balance. However, bee pollen from the two samples contains these minerals and can be used in the absence of other sources such as vegetables. Also, bee pollen can prevent rickets in children and osteomalacia (softening of bone in the adults) because of its calcium content.

**Table 2:** The Micro elements (mg/100g) composition of *Apis mellifera adansonii* pollen and *Melipona* Species pollen

	Iron	zinc	copper	silicon	Manganese	Lead	Aluminum
<i>Apis mellifera</i> pollen	0.26	0.01	0.04	0.11	0.04	ND	0.01
<i>Melipona</i> sp pollen	0.43	0.30	0.05	0.12	0.01	ND	0.02

ND means not detected

The micro elements found in the bee samples were as shown in Table 2, these were; iron, zinc, copper, silicon, manganese and aluminum. Lead was not detected which indicated that there was no poisonous mineral element in the pollen samples. This may imply that bees are very intelligent insects and may not be collecting such mineral which may be harmful. The concentration of the minor elements of the pollen samples were in trace amounts. Iron concentration (0.43mg/100g) was the highest in the micro minerals detected and was obtained from the *Melipona* species pollen. The presence of these minerals in bee pollen has also been reported by [9]. The bee pollen samples analyzed contain iron which is part of the protein haemoglobin which carries oxygen in the blood, also it is part of protein haemoglobin in muscles which makes oxygen available for muscle concentration, necessary for energy metabolism. Also, zinc is present in bee pollen which helps in transporting vitamin A, taste perception, wound healing, the making of sperm and normal foetal development.

#### 4. Conclusion/Recommendation

The results of the analyses conclusively have shown that the main minerals contained by the bee pollen samples were potassium and phosphorus. Also, other essential minerals and trace elements were found which included calcium, magnesium and sodium and iron, zinc, silicon, manganese etc apart from lead which was not detected.

However, it is recommended that bee pollen can serve as a mineral supplement. Also the quantity of minerals obtained

should be used in formulating amount of minerals needed to be fed to the brood in the absence of bee pollen.

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