

# Comparative Study of the Nutritional Value of Four Types of Egyptian Palm Pollens

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**Abstract:** Pollen grains are good sources of vitamins, minerals and amino acids with a high nutritional value that can be used as human food supplement. Date palm pollens are used in the Middle East especially Egypt in herbal mixtures as a folk medicine remedy for curing male infertility and promoting fertility in women. The raw materials purchased from the market are found to be a mixture of several palm pollens.

The main objective of this study was to determine the nutritional value of four local Egyptian date pollen grains {Amhat(A), Hiani(H), Sewy(S) & Zaghlol(Z)} by microscopical and chemical means. These differences could determine the quality of separate pollen grains and show to what extent they affect the quality of the natural products manufactured from them?

Each of the pollen samples were treated identically: collected from locations of similar clay loamy soils, in March 2011 at an early time of the day, subjected to electron microscope examination and chemical analysis of trace elements, amino acids & vitamins. The results showed that there are clear differences in the quality of the four Egyptian palm pollens which could be distinguished microscopically and chemically by the percentage of the trace elements, amino acids & vitamins.

**Keywords:** Egyptian date palm pollen grains, nutritional value, microscopic and chemical analysis.

## INTRODUCTION

Pollens are the male reproductive cells of Palm flowers that were used by the early Egyptians and the ancient Chinese as rejuvenating medicinal agents. They are used worldwide as dietary supplements.

Date Palm (*Phoenix dactylifera* L. F. Palmae) pollens are used in the Middle East especially in herbal mixtures as a folk medicine remedy for curing male infertility and to promote fertility in women [1, 2].

Previous studies showed that Palm pollens in contrast to all pollens lacked starch and volatile substances, and by phytochemical screening it showed the presence of sterols, triterpenes, saponins, proteins, carbohydrates and/or glycosides [3, 4]. El-Ridi, *et al.* [5], isolated rutin, also isorhamnetin-3-O-glucoside, Apigenin, Luteolin-7-O-glucoside and Naringin with estradiol, estriol, estrone were determined [6]. Hassan M.M.H *et al.* [7] determined the percentages of moisture, ash, crude fiber, crude fat, crude protein, carbohydrates, vitamins A, C & E, minerals and amino acids.

The four well known local dates in Egypt are:- Amhat, Hiani, Sewy and Zaghlol which are all named

*Phoenix dactylifera* L. (F. Palmae). Nothing could be traced in the literature regarding these four types of Palm pollens. Pollens chemical composition varies with conditions of handling and storage [8].

Many factors can influence the proportions and kind of the chemical constituents, as the time and season of collection, also the location of palms from which the pollens are collected.

## MATERIALS AND METHODS

### 1. Plant Material

The four different palm pollens were treated similarly and collected from locations of similar soils and climates at the same period of time.

The four Egyptian date palm pollens were collected from 23-25<sup>th</sup> March 2011 at an early time of the day. Amhat (A) from Assuit Governorate, Hiani (H) and Sewy(S) from Sharkya Governorate & Zaghloul(Z) from Kalyoubaya Governorate.

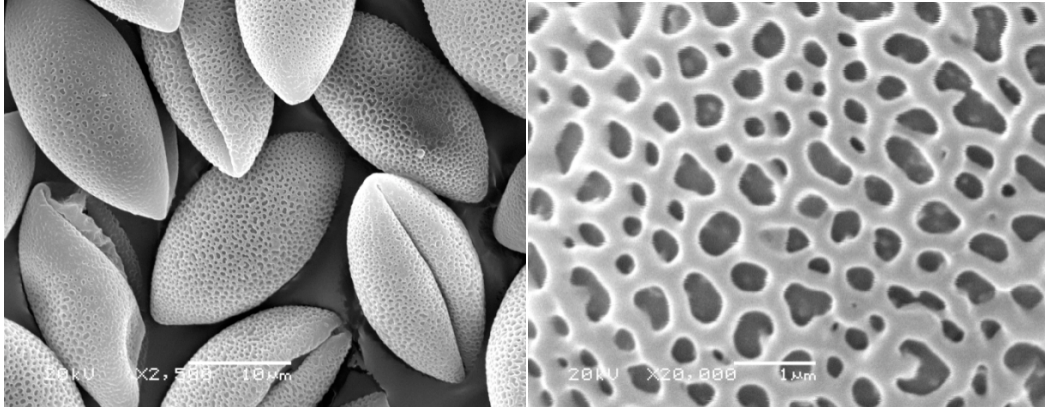
### 2. Microscopical Examination and Photography

Electron microscope was used for the comparison of the four samples

Model: Joel, GSM-6360LA. Analytical Screening Electron Microscope, Analysis was done by Energy Dispersive Spectroscopy {EDS} method.

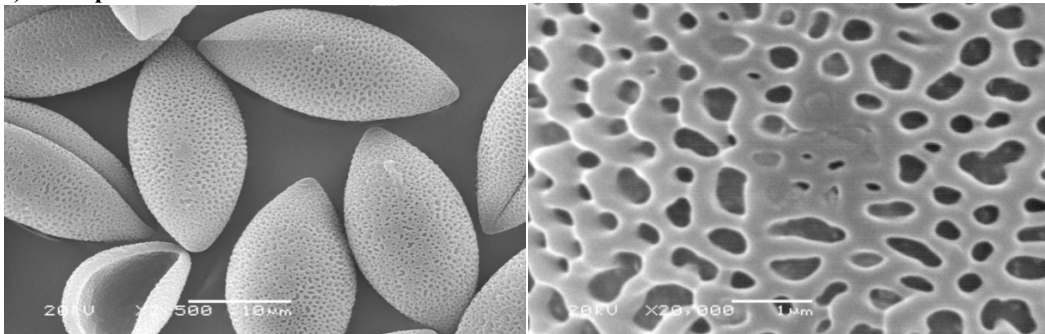
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**1) Amhat pollen**



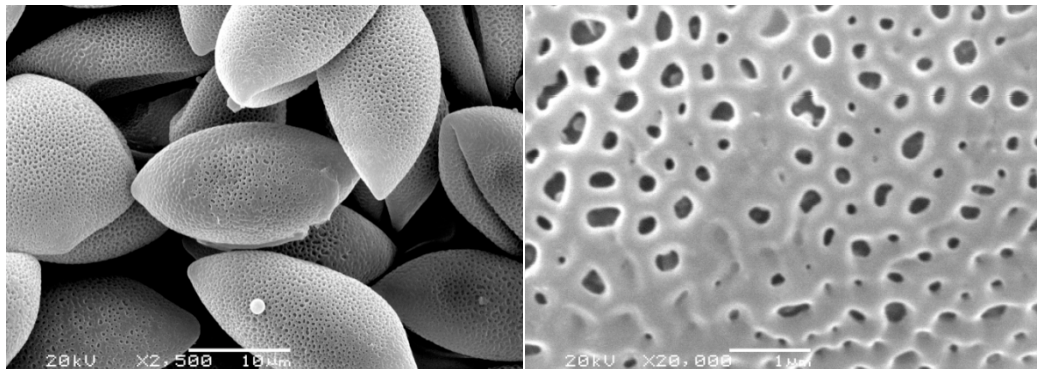
**Figure 1:** Amhat pollen (shape & size X = 2500). **Figure 2:** Amhat pollen (surface X = 20000).

**2) Hiani pollen**



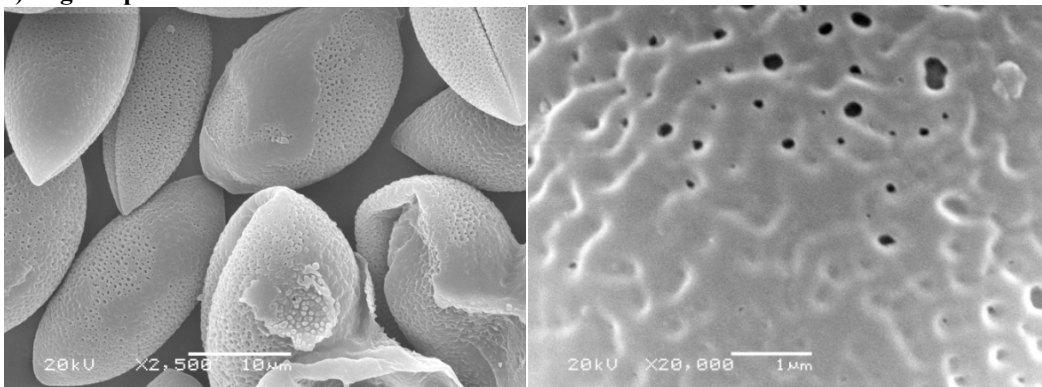
**Figure 3:** Hiani pollen (shape & size X = 2500). **Figure 4:** Hiani pollen (surface X = 20000).

**3) Sewy pollens**

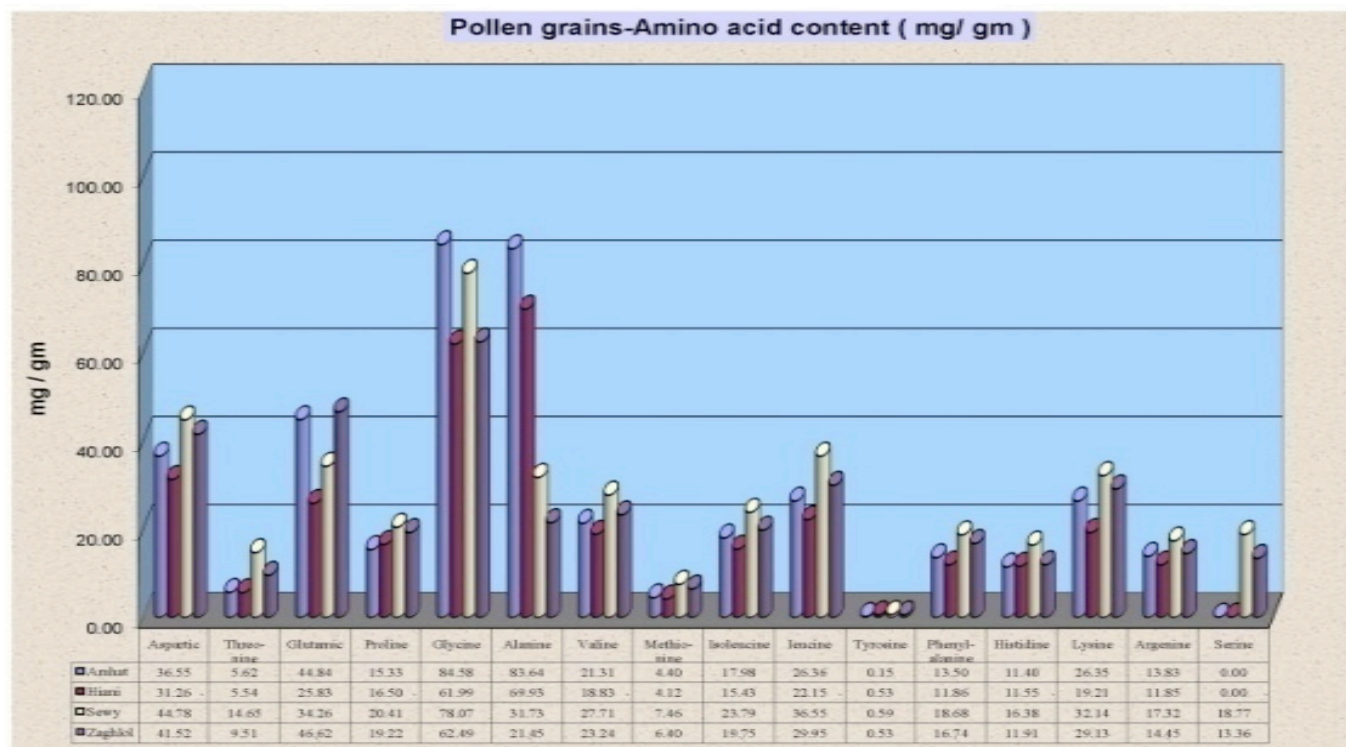


**Figure 5:** Sewy pollen (shape & size X = 2500). **Figure 6:** Sewy pollen (surface X = 20000).

**4) Zaghlol pollen**



**Figure 7:** Zaghlol pollen (shape & size X = 2500). **Figure 8:** Zaghlol pollen (surface X = 20000).



**Figure 9:** The amino acid content in the 4 palm pollen.

### 3. Amino Acid Analysis

#### Method and Equipment

0.1036 g of Amhat pollen, 0.1042 g of Hiani pollen, 0.1042 g of Sewy pollen and 0.1018 g of Zaghlol pollens were weighed, 3 ml of 6N HCl was added to each sample separately in a screw capped tube and digested on a heater at 110°C for 16 hours.

5 ml of water was added to each sample and all samples were lyophilized to get rid of HCl.

The remaining residues were all dissolved in 1 ml buffer and were diluted to 1:100 with water and these four samples were used for injection.

#### Amino Acid Analyzer Used

Sycam amino acid analyzer equipped with:

- S7130 amino acid reagent organizer
- S4300 amino acid reaction module
- S2100 solvent delivery system
- S5200 sample injection

PreColumn used:- ammonia filtration column LCA K04/Na 4.6\* 100 mm.

Column used: Cation separation column LCA K06/Na 4.6\* 150 mm.

Injection volume used: 100 µl.

### 4. Elemental Analysis

This was done by using the above mentioned electron microscope on compressed powder.

### 5. Vitamin Analysis

#### Sample Preparation and Equipment

100 mg of each sample were weighed and dissolved separately in 10 ml water, filtered and used for injection using: HPLC, Agilent 1100 series equipped with:

Quaternary pump G1379A, Auto sampler G1313A, Multiwave length detector G1365B, Fluorescence detector G1321A, Column: Hypersil 5 µm, 15 Cm\*4.6 mm ID. And Gradient technique:

Mobile Phase A: 0.1 % formic acid in water.

Mobile phase B: Acetonitril + 0.1% Formic acid.

Use 4% of B for 3 minutes, then to 100% in 12 minutes.



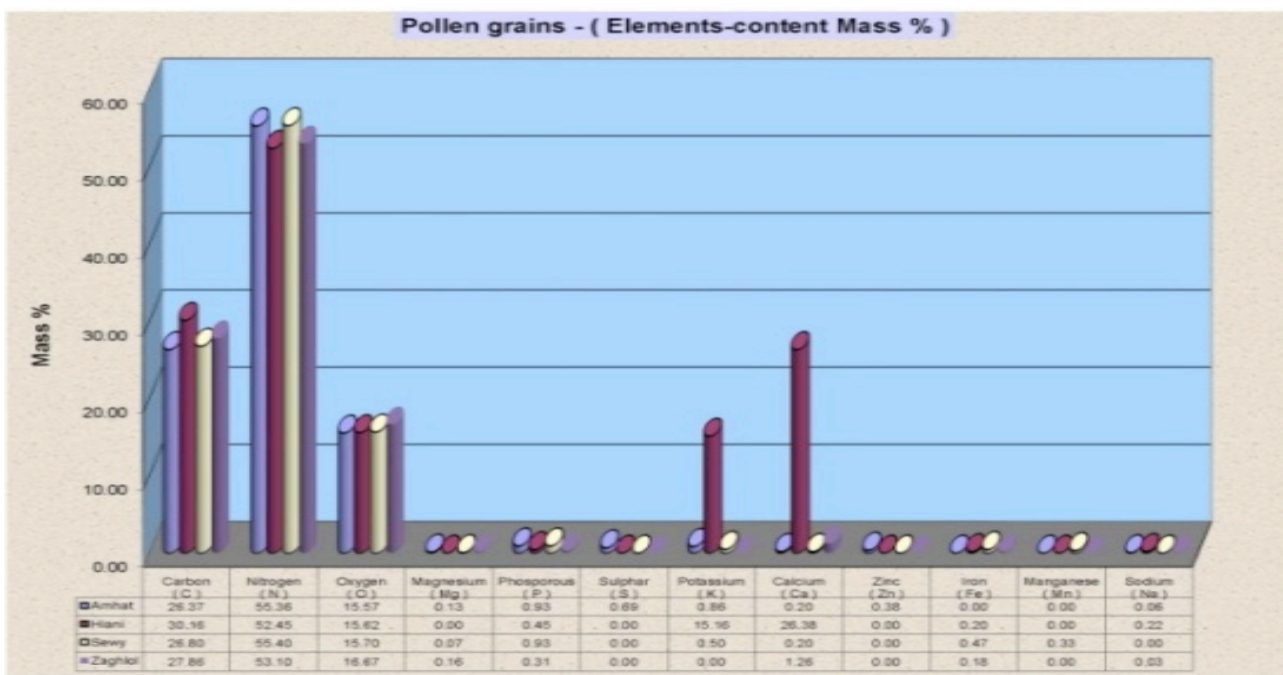


Figure 10: The elemental content of the 4 palm pollens.

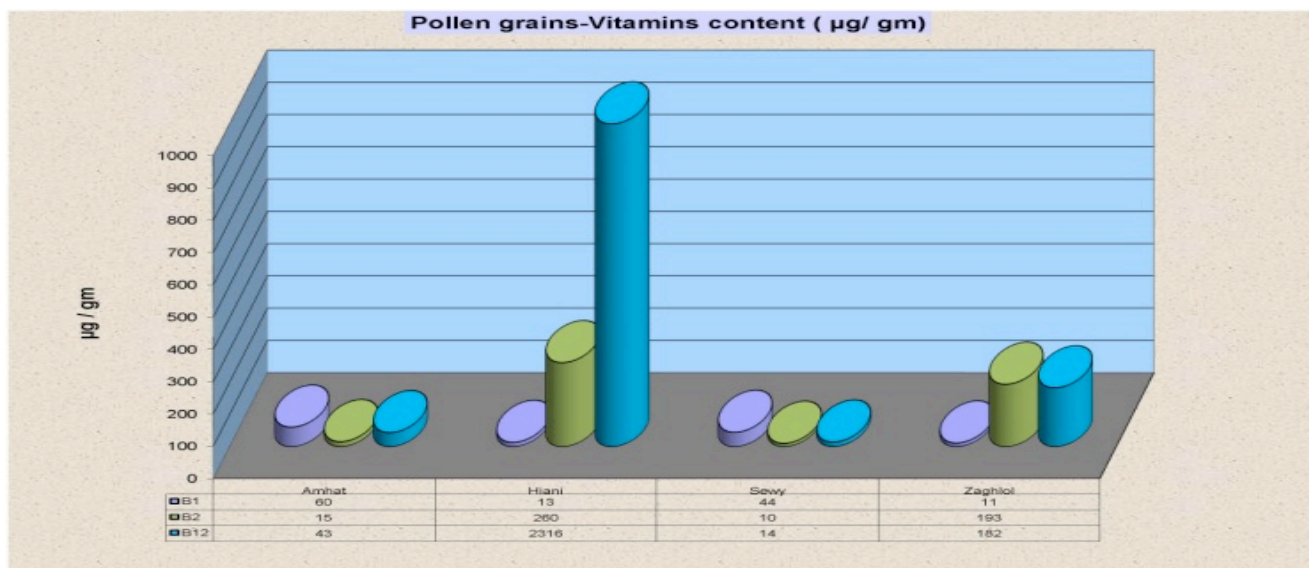


Figure 11: The vitamin content of the 4 palm pollens.

Flow rate: 1ml/minute.

Wave length: 266 nm.

Column temperature: 25°C.

Injection volume: 10 µl.

**RESULTS**

**Microscopical Examination**

Showed the presence of a strongly porous, spongy surface of pollens in case of Amhat palm pollens, while the Hiani pollen surface has very slight flat patches.

Clear flatness was observed in Sewy while Zaghlol was nearly flattened and very slight porosity is observed.

**Chemical Analysis**

The chemical analysis of the four palm pollens revealed the presence of certain essential and non-essential amino acids (Table 1), trace elements (Table 2) and vitamins (B<sub>1</sub>, B<sub>2</sub> & B<sub>12</sub>) (Table 3) in all of the samples but in different percentages. The presence of either Serine or Alanine amino acid or both together, and the occurrence of some elements and absence of others, were all found to be indicative for each of the four types of pollen grains.

**Table 1: Amino Acids Analysis**

Pollen Grains-Amino Acid content (mg/gm)					
	Amino Acid	Amhat mg/gm	Hiani mg/gm	Sewy mg/gm	Zaghlol mg/gm
1	Aspartic	36.55	31.26	44.78	41.52
2	Threonine	5.62	5.539	14.65	9.51
3	Glutamis	44.84	25.83	34.26	46.62
4	Proline	15.33	16.50	20.41	19.22
5	Glycine	84.58	61.99	78.07	62.49
6	Alanine	83.64	69.93	31.73	21.45
7	Valine	21.31	18.83	27.71	23.24
8	Methionine	4.40	4.12	7.46	6.40
9	Isoleucine	17.98	15.43	23.79	19.75
10	leucine	26.36	22.15	36.55	29.95
11	Tyrosine	0.147	0.527	0.59	0.528
12	Phenylalanine	13.5	11.86	18.68	16.74
13	Histidine	11.40	11.55	16.38	11.91
14	Lysine	26.35	19.21	32.14	29.13
15	Argenine	13.83	11.85	17.32	14.45
16	serine	----	-----	18.77	13.36

**Table 2: Elemental analysis**

Pollengrains-(Elements-content Mass%)					
	Element	Amhat	Hiani	Sewy	Zaghlol
1	Carbon (C)	26.37	30.16	26.80	27.86
2	Nitrogen (N)	55.36	52.45	55.40	53.10
3	Oxygen (O)	15.57	15.62	15.70	16.67
4	Magnesium (Mg)	0.13	-----	0.07	0.16
5	Phosphorous (p)	0.93	0.45	0.93	0.31
6	Sulfur (S)	0.69	-----	-----	---
7	Potassium (K)	0.86	15.16	0.50	---
8	Calcium (Ca)	0.20	26.38	0.20	1.26
9	Zinc (Zn)	0.38	-----	-----	---
10	Iron (Fe)	-----	0.20	0.47	0.18
11	Manganese (Mn)	-----	-----	0.33	---
12	Sodium (Na)	0.06	0.22	-----	0.03

## DISCUSSION

The presence of Serine amino acid indicates the presence of either Sewy or Zaghlol pollen grains. As shown in Table 1, absence of serine amino acid is substituted {compromised} by the presence of much higher amounts of alanine in the other two types Amhat and Hiani. These two amino acids are very similar in structure; methylenic hydrogen is replaced by a

hydroxyl group in serine making it hydrophilic. Although these two amino acids are non essential amino acids and can be formed by the body in the presence of vitamin B, they are very important for the overall good health, physically and mentally. Serine is related to the proper functioning and structure of both the brain and CNS. It forms proteins of the brain, which are used for the formation of myelin sheaths that cover the nerves and are important for the good transmission of

**Table 3: Vitamin Analysis**

Pollen Grains---Vitamins content (mg/gm)					
	Vitamin	Amhat µg/gm	Hiani µg/gm	Sewy µg/gm	Zaghlol µg/gm
1	B <sub>1</sub>	60	13	44	11
2	B <sub>2</sub>	15	260	10	193
3	B <sub>12</sub>	43	2316	14	182

chemotransmitters. Also serine takes part in serotonin synthesis, which is a mood determining brain chemical, and is linked to depression, insomnia, confusion and anxiety. Additionally it is important for the immune system as it is related to immunoglobulin and antibodies formation. Alanine on the other hand is a non polar ambivalent amino acid and is involved in gluconeogenesis and in stabilizing glucose level in blood and also decreasing cholesterol levels.

From Table 2 Amhat pollens receive their medicinal importance from being the only type containing (S and Zn), sulfur is useful in assisting the immune system and fighting the effects of aging, as well as age related illnesses such as arthritis, while Zinc is needed to manufacture testosterone and is necessary for a healthy immune system. It is further needed for cell division, growth and maintenance of muscles. It also helps to control the oil glands, and is needed for the synthesis of protein and collagen - which is great for wound healing and healthy hair, nails and skin, fighting skin problems such as acne, boils and sore throats.

The presence of manganese Mn in Sewy pollens keeps bones strong and healthy; helps the body make chemicals that help in digestion of food, synthesis of fatty acids and cholesterol. Also manganese is important in maintaining normal blood sugar levels, supporting the immune system, and is involved in the production of energy and cell reproduction. With vitamin K it supports blood clotting, while with the B-complex vitamins, maintains the health of nerves and contributes to ones sense of well being, Promotes optimal function of thyroid gland and protects cells from free-radical damage.

Table 3 showed that the four types contain variable amounts of vitamins {B<sub>1</sub>, B<sub>6</sub> & B<sub>12</sub>}. The presence of a relatively high content of Vitamin B<sub>12</sub> indicates the presence of Hiani date pollen grains. Vitamin B especially vitamin B<sub>12</sub> is important for blood cells formation and in prevention of brain atrophy and shrinkage as in Alzheimer.

From the aforementioned microscopical and chemical analysis of the four Egyptian types of date palm pollens, it was concluded that the large flattened patches on the surface of the pollens with the presence of serine amino acid and absence of sulfur S and zinc Zn could mean Zaghlol or Sewy palm pollens. The presence of manganese Mn and absence of sodium Na would indicate Sewy type of pollen and differentiate it from Zaghlol.

Amhat and to a lesser extent Hiani pollen surfaces are microscopically characterized by being porous, and chemically by the absence of serine which is compensated by the presence of more than double the amounts of alanine amino acid compared to the former two types {Sewy and Zaghlol}. The presence of a much higher amount of Vitamin B<sub>12</sub> in Hiani differentiates it from Amhat palm pollens.

These results could be used as markers to identify and differentiate the sources of the investigated date palm pollens that are used in the medicinal preparations as well as, in judging the quality of the commercial raw material of the palm pollens.

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