

Zeatin - a Powerful Antiaging Factor

By now, you must be impressed by the richness and versatility of this incredible tree.

Everywhere it grows, in India or Niger, Arabic countries or Nicaragua, Moringa has been embraced and recognized as a valuable nutritive and healing source. In regions with harsh climates, where food resources are scarce, **just 25 grams of Moringa leaf powder can provide a child with about half the protein amount, all the calcium and vitamin A, a quarter of vitamin C and three quarters of iron** needed daily!

What a nutritious power plant, indeed. Recent studies have discovered that Moringa might have even more exciting properties than previously thought. Biochemical analysis has revealed that the Moringa leaves and leaf powder contain **unusually large amounts of plant hormones named cytokinins**, such as **zeatin** and the **related dihydrozeatin**.

Cytokinins function as **plant hormones**, which are naturally occurring growth promoters and factors that **delay senescence** (the process of aging) in many plants.

Furthermore, research studies have shown that plant cytokinins may be very active in animals, as well. We will discuss below the functions and significance of cytokinins, in general and zeatin in particular, in the process of aging. You will be surprised to find out how **zeatin can help your skin, hair and more**. Remember when I called Moringa a beautician? If you were wondering then, now zeatin should solve this puzzle. . . in a beautiful way.

Cytokinins are compounds with a structure resembling **adenine** - one of the major components of the **genetic material encoding information in the cell nucleus**. Cytokinins have been found in almost all higher plants, as well as simpler organisms such as fungi and bacteria (single cell organisms), therefore they must play a vital role in the lives of plants. Indeed, cytokinins regulate a wide number of processes such as:

- * flowering.
- * germination of seeds.
- * healing of wounds.
- * the accumulation and synthesis of nutrients (proteins, minerals).
- * ultimately, **cytokinins** control **plant growth** by **stimulating the cell division** (known as cytokinesis) and multiplication of plant parts. They stimulate the synthesis of nucleic acids (which encode the genetic information necessary for cell functioning and multiplication) and proteins.

In other words, thanks to the dynamic cytokinins, plants know when to grow more leaves or when to expand their roots, when to sit silenced, or when they should bloom again. One could compare a **cytokinin with the director of a huge philharmonic orchestra of cells**. The director gives the entry for every cell type, I mean the start for division and growth, or signals their end. All has to be, of course, harmonious and perfectly in tune with Nature's music (seasons, light, temperature, humidity), otherwise plants would not survive.

In addition, **cytokinins delay the aging**, the **destruction of plant tissues** and **postpone death**. In the 1930s, it was discovered that tomato roots could be cultured in an artificial medium indefinitely, while continuing to grow roots, if they were supplied a natural plant extract containing (what proved later to be) cytokinins. Since then, scientists have uncovered many of the miraculous plant hormones and today there are more than 200 known natural and synthetic cytokinins.

Kinetin was the first cytokinin discovered, although it is not sure if plants synthesize it, therefore it is considered a synthetic cytokinin. The most common and the **most active** naturally occurring cytokinin in plants is **zeatin**, which was first isolated from corn (named *Zea mays* in Latin). Let's explore now how zeatin can delay aging.

Cytokinins and Aging

How do cytokinins delay aging in plants? What about their effects on animals and humans? These questions are not yet fully answered, although new and exciting data reveals insights about their mechanism of action in plants and animals.

Briefly, cytokinins may act through a number of ways to stimulate the enzymes and processes involved in regeneration of tissues, while protecting against degrading enzymes and damaging free radicals. (Enzymes are the workforce of the body; substances that activate or inactivate all physiological processes. However, some enzymes are involved in destroying and possibly damaging cellular structures.) In order to understand the effects of zeatin and other cytokinins, we should first review some of the key issues about aging in plants and animals.

Organism aging is characterized by a declining ability to respond to stress, increased biochemical imbalances and the occurrence of diseases (especially degenerative diseases), with death as the ultimate consequence. While we tend to notice mostly the external effects of aging, for instance on skin and visual acuity, actually aging occurs first at the level of the minuscule living units - the cells. Every day, **cells age and die in our bodies**, and in plants for that matter. Cellular senescence (aging) can be demonstrated in the laboratory: various isolated cells have a limited ability to divide in culture. In other words, they divide and grow for a fixed number of times, and then they stop multiplying and die. A variety of cell biology alterations occurs as the cells progress from young and vigorous, to old and dry. As a consequence, we all function according to a biological clock, ultimately dictated by our cells. **Genetic and environmental** factors may affect the life span of cells and organisms, as a whole.

Importantly, ***it is believed that certain nutrients may affect the rate and occurrence of aging***. This gives much hope to many that human aging can be slowed and has spurred intense research efforts within the field of senescence.

Surely enough, we all hope for a long and healthy life, but how to reach that is still under debate. Groucho Marx once said that anyone can get old; we just have to live long enough! **Longevity** requires that we **nourish our bodies properly, support the extraordinary healing power within us and fight diseases wisely - by using natural laws and the best medicines**. A wholesome diet that strengthens our inner powers and delays aging should include the necessary nutrients, plenty of vitamins, essential microelements and protective

phytochemicals that minimize tissue damage inherently occurring with age. Among the phytochemicals, cytokinins might play a crucial role.

Various experiments have shown that cytokinins like zeatin or kinetin have **potent antiaging and protective effects in animals** (including humans), similar to their activity in plants. Could that be possible, taking into consideration the physiological and anatomical differences between plant and animal kingdoms?

Well, it seems so. Plants, like animals, do have regulated growth, determined phases of tissue differentiation, specialized cell types and sophisticated communication between cells. Apart from obvious differences, plants and animals share a majority of biological compounds (proteins, lipids, sugars, vitamins, and minerals), and their genetic material encodes information according to similar formulas.

Even basic cell organization is quite similar, as well. Plant cytokinins might be physiologically compared to animal hormones - endogenous substances that control development, growth, metabolism and other various functions in animals.

Zeatin, similar to kinetin and other cytokinins, has **potent antioxidant** properties as well. As described in the chapter dedicated to the antioxidants, aging can be equated to an increased oxidation of cell components such as proteins, genetic material and lipids. Upon oxidation, they change or lose their normal functions, thus leading to a disruption of normal physiological processes. Plants are the main source of powerful antioxidant substances that can trap and neutralize the damaging free oxygen radicals. By acting as an antioxidant, **zeatin becomes another valuable substance in the fight against premature aging.**

Evidence for the antiaging effects of zeatin and other cytokinins is presented below. We have seen that cells in plants and animals divide for a preset number of times, then they stop dividing and die. This process dictates organism aging, and is controlled, at its turn, by a number of factors - both internal and external to the plant or animal. We have also described briefly that oxidation of vital cellular components triggers aging, often prematurely. Plants are considered today as the main source of powerful antioxidant and antiaging substances. Therefore humans should include a broad variety of plants, including fruits, herbs, legumes, roots, and others, in their daily diet, in order to delay aging and maintain excellent health.

Scientists, in their quest for understanding life and improving its quality, have gone one step further and purified certain plant components. These were studied in the laboratory or field and applied to various experimental systems in order to elucidate their mechanism of action. Upon careful consideration, the **most active plant components were selected**, concentrated, purified, and many can be found on the market as supplements for human diet. Since cytokinins have proved to be such an exciting group of phytochemicals, scientists have put them to the test.

Cytokinins have proven to delay biochemical modifications associated with aging in cultured human cells. Experiments conducted in Denmark, in association with American researchers, have shown that kinetin solutions that are applied to human cells (fibroblasts) lead to significant delays in the onset of aging and cell death. The treated cells maintained much longer their youthful characteristics (biochemical composition, skeletal and shape organization, active protein and genetic material synthesis). They were not accumulating age

pigment like substances. These effects are seen as preventative, since no additional cell divisions were triggered. Human cells were growing continuously and remained younger while under the influence of kinetin.

* Zeatin protects the skin. **Zeatin has demonstrated even better properties than kinetin in a similar experimental system.** Human skin cells treated with zeatin retain their functions longer, do not accumulate biochemical damage associated with aging and are more resistant to environmental stresses. Besides its mechanism on cell growth, and as described above, zeatin has potent antioxidant properties. **It can increase the activity of known antioxidant enzymes, such as catalases, that naturally fight aging and free oxygen radicals.** In other words, zeatin acts synergistically with other inner antiaging molecules, orchestrating a stronger offensive against senescence.

These impressive results have led to the development of skin and hair care products containing kinetin and zeatin, in Europe and the USA. These effective and unique preparations protect against environmental damage, delay skin aging and improve skin barrier functions (allowing better humidity retention and elasticity). **By comparison with other antiaging substances, cytokinins do NOT induce peeling, dryness or exfoliation with consequent thinning of the skin.** In other words, youthful skin without risks! The effectiveness in maintaining normal cell functions and safety for local use could make **cytokinins the ingredients of choice for preserving healthy skin.** Another conclusion to be drawn from here is that cytokinins work in living animal organisms, not only in their cultured, isolated cells.

Clinical studies with human subjects on cytokinins treatment have also demonstrated an excellent efficacy in photo damaged skin (visible light and UV damage). **These preparations reduced skin wrinkles and roughness within 8-24 weeks in almost all patients treated.** Scientists are further testing and proposing the introduction of cytokinin combinations for even better activity.

Zeatin protects animals against **neuronal toxicity induced by age-specific proteins.** One of the main characteristics of **brain aging** is the accumulation of modified, non-functional proteins that often aggregate as insoluble particles. These are named **amyloids** and are believed to play an essential role in the **development of brain degenerative diseases such as dementia.** Since people are living longer and the number of cases of dementia has increased dramatically, scientists are intensively looking for preventative treatments against age-related brain diseases. Studies have shown that zeatin administered to mice can effectively **protect them against memory and brain performance loss triggered by amyloids and chemical agents.** It makes sense to believe that, if zeatin is an antioxidant and stimulates proper skin cell functioning and metabolism, it could also work as an antioxidant and protector for the neurons (the brain's main cells). Further studies are ongoing to clarify the importance of zeatin supplements for delaying brain aging.

Zeatin has another interesting property that could be exploited in the treatment of some forms of dementia (Alzheimer's disease). This cytokinin can enhance **neuronal function and transmission of the signals by increasing the amounts of acetylcholine** (a natural substance used by neurons for signaling from one to another). In **Alzheimer's** disease, **acetylcholine** concentration is much lower than normal; therefore the transmission of

information by neurons becomes defective and slow. Zeatin is one of the most powerful substances that increases the amount of acetylcholine in the brain by inhibiting its degradation by specific enzymes. In summary, zeatin was proven to exhibit antioxidant, neuroprotective effects through a number of different mechanisms. Its presence could be very beneficial against brain senescence.

Zeatin and cancer. One of the most frequent diseases of old age is cancer. Actually "cancer" is a complex set of many diseases, all characterized by some common biochemical changes occurring in cancerous (tumor) cells. Cell oxidation plays a major role in cancer development. Due to accumulated defects in the genetic material, cells lose the tight growth and function control that keeps them healthy and "well-behaved". The cancerous cells start to divide too rapidly and many become nonfunctional, leading to tumors. Many of the tumor cells behave as "non-differentiated". The cells are unable to decide which type of structure and growth path to take. It was shown that zeatin can inhibit cancer cell growth by "directing" them on the right path, and differentiating them into normal cells. The normal cells thus reverted; regain the normal, tight control that keeps them from dividing chaotically. These studies on zeatin's effects in cancer are still ongoing, but they show great promise.

But what is the concentration of zeatin in Moringa? Is Moringa a common source of zeatin or rather an exceptional one?

Zeatin is found in many, if not most, superior plants. The amount of zeatin in various plants or even the same plant may vary according to the phase of growth, season, temperature, part of the plant analyzed, the use of fertilizers, etc. Scientists have found zeatin in very low concentration in plants. (generally, plant hormones are very active substances; therefore their concentration does not need to be high.) Of course, many plants have not been tested yet for zeatin concentrations, but for those tested, the zeatin amounts vary between .00002 mcg/g material to .02 mcg/g. **The zeatin concentration in Moringa leaves gathered from various parts of the world was found to be very high, between 5 meg and 200mcg/g material, or thousands of times more concentrated than in most plants studied so far.** [IBC Laboratory, Tucson, AZ] We do not yet know what is the significance of this unusually high amount of zeatin: maybe it could be linked to the very fast growth of this plant, or to its extraordinary nutritive richness, or to both. Definitely, it is not just a coincidence. Moringa is so unusual in so many ways. We do not yet know how zeatin is absorbed in the body from Moringa, or how and if it affects the internal tissues. But, as detailed above, in cell cultures and human skin, zeatin is very beneficial and can prevent or reduce damage due to environmental factors. We are anxiously waiting for more studies to explain the "**zeatin effect**", and believe it could be as spectacular from inside as from outside of the body (or external application, as performed in the studies).

Zeatin is a normal, **dynamic hormone** in many plants. It functions to control growth, healing and the accumulation of nutrients.

Zeatin **delays aging** by its influence on cell division and antioxidant properties.

Recent and ongoing studies have shown that zeatin and related plant hormones have **antiaging, skin protective and antioxidant** properties in animals, including humans.

Zeatin **protects animals against neuronal toxicity** induced by age-specific factors.

Zeatin **inhibits cancer cells** (in laboratory setting) and induces their differentiation into normal cells.

Moringa is indeed extraordinarily rich in zeatin.

FINAL THOUGHTS AND CONCLUSIONS

Although it is hard to say good-bye to my friend, Moringa, I have to. Actually, Moringa will stay with me forever, as she remains with so many other people, as well. For the purpose of this book, though, I have to finish somewhere. I know some will read the beginning and the end first, in order to decide if they are truly interested in the whole book. In any case, closing remarks are always important - many readers will only remember those over the long run.

Before summarizing the many wonders of Moringa, I would like to expand more and explain why a **plant-based diet** is so important in the **prevention of serious, chronic diseases**, against which, we have poor weapons (read treatments). I am not going to throw too many numbers and statistics at you, I have done it already; besides, you can find the cited articles in the references if you need more details.

My call is for **sound thinking** and, above all, inspiration from **Nature**, which is the greatest, most successful, oldest scientist of all. The most compassionate physician, as well!

We humans ARE part of Nature, there is no other "external" environment, we are the environment. As such, we should function according to the basic rules of Nature for proper physical and mental health. Since we were meant to eat mostly plants, as omnivorous creatures, the best way to remain functional and healthy is to continue ingesting mostly plants, especially non-cooked plants. **Have you ever seen an obese wild monkey** or a depressed bear (except for those in cages...)? What about hypertension, cancer or atherosclerosis in our closest omnivorous cousins? No, for as long as they have the choice, our wild relatives will choose the right food. They will eat the food that keeps their legs agile, eyes sharp, and their bodies cancer-free.

The only situation in which wild animals get cancer is when they are exposed to human-created pollution. (Funny, I think, how we create the pollution that sickens us with asthma and cancer, then we struggle in so many other ways to fight these diseases, instead of addressing the cause and cleaning our internal and external environments.)

Some might argue that animals feed while humans "eat". In other words we have transformed the basic ingestion of nutrients into a social, sophisticated event; we seek the pleasure and satisfaction (taste) above all.

I personally think it is the lack of basic nutrition education that leaves some ignorant or indifferent to their true organic needs. The other main reason is the total dissociation from Nature, or our own roots and who we really are. **The consequences are many and sad, among these - a plethora of chronic diseases and physical weaknesses.**

In the case of cancer, for instance, it is clear now that most types of **cancer can be prevented or delayed by a healthy life style, especially a diet rich in vitamins and antioxidants**. Healthy life style also means natural or "normal" - as normal as it used to be when we enjoyed clean food, water and air, and were forced to move a lot. Did you know that there are thousands and thousands of scientific studies and publications about what can inhibit and how cancer can be prevented by various plants or plant-derived substances? By contrast, there is **not a single study showing that animal-based food can prevent cancers**, on the contrary! Even baked foods (such as bread) and grilled meat have proven to contain cancer-promoting substances. I do not mean to scare you, but rather to draw your attention to a crucial aspect of our diet and how is it connected to our poor state of health, from poor eye sight to cancer and heart disease.

If I have to choose the single most important group of substances that are really needed but are not well represented in the Western diet, I would select the **antioxidants from plants**. Or, better, I would say, eat a lot of non-cooked plants! Green or colorful, canned or not, fresh better than cooked (although sometimes cooking preserves certain antioxidants), organic if possible, or whatever you can afford, just get back to your roots and eat what you were designed to eat for, the best physical and mental state. **You would be surprised to notice the positive changes and the energy you will draw from plants**. If you are still skeptical, I say this to you; "no matter what your dietary education or habits are, if you really eat properly, when you get up from the table you should feel light, energized and clear-minded." In the long run, you should:

- * **rarely suffer from colds, constipation, migraines.**

- * **have fewer wrinkles and joint pains, no need for eye glasses.**

- * **definitely have no heartburn, high cholesterol or hypertension, to name just a few health troubles.**

If you suffer from any of these, your diet is not what it is supposed to be.

I still cannot understand those who continue to eat a specific type of food no matter what clear signs of stomach distress they might get afterwards. The pill against heartburn will not stop the erosion of the gastric mucosa following a stupidly chosen meal. Even more, remember - plant-derived foods will not distress your stomach, they will protect the gastric mucosa (unless it is already ruined by previous poor eating habits). The distress most likely comes from the animal - based foods you eat.

I, for one, if science and Nature would prove that by eating stones one could prevent cancer, I would definitely stick with the stones. I have seen enough suffering..., fortunately, Nature provided a much tastier alternative - the **PLANTS** - so I stick with them. Statistically, did you know that one in three Americans might get cancer today? These statistics look even worse for the future: in 30-50 years, one in two Americans will probably have cancer! What about in 100 years? I do not know, but what I know is that humans are not guaranteed perpetual survival. On the contrary, we are just one of many other animal species and, according to science, **more than 90 % of species that have ever lived on earth have already vanished**. I also know that, the further we stray from our natural eating

habits, the weaker and more prone to diseases we become. Draw your own Conclusions and act accordingly.

I briefly expose these serious health threats and their link to Western diet, for a better appreciation of plant derived food and - the role Moringa could play in it. You can continue to eat what you ate before, or you could ponder better alternatives. I personally trust plants to keep me healthy and energetic, the way I trust Nature to show me the path of wisdom in everything. After all, Nature has experimented on a large scale, and successfully created a myriad of opportunities and solutions for hundreds of millions of years! Among them - **the Miracle Tree - Moringa**. We humans have played and experimented with food for just a few thousand years or so (while junk food is much younger, of course). We started to invent and synthesize medicines less than 100 years ago...

This rather short book introduces you to Moringa oleifera, an unusually beneficial tree, in so many ways. **My wish is that, upon reading it, you can understand her nutritional and medicinal value, and begin to appreciate Earth's amazing, still largely unknown green heritage.** I have collected and put together information about Moringa's world-spread fame, extraordinary medicinal and nutritive qualities, and why her introduction into our diet could be so valuable. I mean human and animal diet. I hope to have covered the most significant data and selected the most interesting facts, although I cannot claim to have covered all, or satisfied everybody. Please keep in mind that Moringa is studied and grown in many parts of the world, within various climates and conditions; therefore, the biological data and nutritive contents can vary widely from place to place.

Besides this book, there are other valuable re sources on Moringa out there, many web sites and related articles, cooking recipes, seed sources and others. Please review the **"References and Resources of Information on Moringa"**. The book **"Moringa, Nature's Medicine Cabinet"** by S. Holst includes many cooking recipes using various parts of the plant.

Unfortunately, it is very **difficult to find fresh Moringa on our Western markets**, but one can find canned or frozen pods in gourmet stores and some Asian markets. I plan to keep growing this wonderful plant for a continuous supply in my own house, although today we now have it readily available in a tasty Moringa product (**Zija International**).

Let me remind you again why this plant could be so valuable for each and every one of us, from East or West:

Moringa oleifera is extremely **rich in vital nutrients**, and, as a bonus, can grow very fast even in dry areas of the world, where food is scarce. Since ancient times, she was used as a medicinal plant, known to heal and ease a wide **number of diseases: from various inflammations to cancer, from parasitic diseases to diabetes.** In more recent times, Moringa has gained notoriety as a nutrition power plant that can feed the needy and, in fact, save lives. And **eyes...** from blindness due to lack of vital nutrients such as vitamin A in the diet. Moringa leaves or leaf powder can be used successfully as a complex food to nourish small children, pregnant or nursing women, and, of course, anybody else. In terms of nutrients, the leaves contain all the essential amino acids, present in harmonious combinations and significant amounts, readily bioavailable.

Moringa can be, from this point of view, better than or at least as good as soy beans and soy protein.

Moringa seeds are rich in an excellent oil, very similar in quality and composition to olive oil, one of the healthiest, most studied fatty foods. The replacement of animal fats in the diet with vegetal fats such as olive or related oils has been clearly linked with beneficial health effects and reduction in cardiovascular diseases and cancers. The list of Moringa's nutrients goes on:

essential minerals such as calcium, potassium, iron, and selenium, are present in Moringa, often more abundantly than in most plant sources we know of so far.

Iron is much higher in Moringa than in spinach, for instance. **Vitamins C, B 1, B2, E, and pro-vitamin A** are also present in significant quantities that make oranges or carrots pale by comparison. In addition, Moringa contains numerous phytochemicals (specific plant-derived chemicals) that act as antioxidants or antiaging substances, stimulating rejuvenation of skin and mucosa, or energizing and detoxifying the body.

These beneficial substances are hormones (zeatin), others and plant pigments (flavonoids) such as rutin and quercetin, to name just a few. All these naturally occurring nutrients and medicines of Moringa are known to be best absorbed and active in the body if derived from natural sources (such as plants), and are present in complex combinations. Many of these beneficial substances act synergistically, enhancing each other's properties.

Not less exciting are Moringa's medicinal properties, as described in the chapter dedicated to the medicinal uses of this plant around the world. What is more interesting is that science continues to validate the ancient traditional therapeutic uses of Moringa.

Recently, novel derivatives of thiocarbamates and nitrites which stimulate insulin release in animals have been found in Moringa. These compounds and their action explain the **anti-diabetic properties** of the Miracle Tree. The list with valuable, recent medicinal discoveries related to Moringa goes on and on. One would need hundreds of pages to mention all the discoveries and describe their content.

Now that you understand better the value of this plant to us, you might consider as justified all those suggestive, affectionate names people gave Moringa: **"Miracle Tree," "Mother's Best Friend," and "Never Die." I could not think of a better name...**