

## FREE RADICALS AND ANTIOXIDANTS IN THE SKIN AGING PROCESS

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### **Abstract**

*Numerous effects of the skin and organism aging process are caused by the oxidative aggression of free radicals. The protection against their attacks is given by antioxidants, which stop their chain oxidation reaction. The adequate antioxidants level may be found by measuring them at the skin level, using the biophotonic Scanner Pharmanex®. It offers information about the skin oxidants level. The measurements show a low level of antioxidants compared with the normal values, the lowest ones being registered among young persons and persons over 70 years old.*

**Keywords:** aging, free radicals, antioxidants, biophotonic Scanner.

### **INTRODUCTION**

The aging process of the organism is a physiologic and irreversible process and, within this process, skin represents one of the most precise indicators, by the complex modifications that take place at its level. An important role within the extrinsic factor has the action of solar radiations that generate free radicals. These have a destructive action upon the tissues. The antioxidants are those that offer protection against the attacks of the free radicals, can control them, slowing back the aging process.

The present paper presents the way the oxidative action of the free radicals influences the level of antioxidants of the skin, by measuring and monitoring the evolution of these values in case of different age groups.

### **MATERIAL AND METHODS**

Because the oxidative aggression of the free radicals is one of the important causes of skin aging, it is necessary to know if the organism, respectively skin have enough protection ability against their harmful action. This thing may be established by revealing the level of antioxidants at the skin level, the SCS (the skin carotenoid score or oxidants).

The measuring of the antioxidants from the skin level can be made using the biophotonic Scanner Pharmanex® that can measure the carotenoids, namely the antioxidants, at the skin level, offering data about the antioxidant protection ability and the protection power against the oxidant aggression of free radicals.

The Scanner uses an optical-spectral method, named spectroscopy through Raman resonance, with the help of optical signals of blue laser. It has a wave length of 375 nm and the moment the emitted optical signals touch the skin they identify the molecular structure of the antioxidants (carotenoids) from the skin cells. When the blue laser wave comes in contact with the antioxidants, the vibration of these molecules takes place and the length of the laser wave reaches 410 nm, becomes blue and reflects itself on the spectrograph that records the value of the skin oxidants level.

The SCS score indicates the stable level of antioxidants and offer an exact biometer of the antioxidant protection. The investigation is simple, noninvasive, has not contraindications and can be made on each person, without prior preparation.

The measuring is made at the level of the palmar face of the hand by holding the hand on the metallic holder of the Scanner, in front of the aperture through which the optical signals are emitted.

The result of the measuring is recorded on a diagram with a scale with 5 levels of the values, having different colors.

The first level has the lowest values and is contained between 10.000 and 19.000 antioxidant units and is colored in three nuances of red, from light to dark red. The second level of values of the gradation scale is contained between 20.000 and 29.000 antioxidant units and is colored in three nuances of orange, from light to dark orange. The third level of values is contained between 30.000 and 39.000 antioxidant units. It is colored in three nuances of yellow, from light to dark yellow. The fourth level of values is contained between 40.000 and 49.000 antioxidant units and is colored in three nuances of green, from light to dark green. The fifth level of values of the scale, the last one, is contained between 50.000 and 59.000 antioxidant units, being colored in three nuances of blue, from light to dark blue.

40.000 antioxidant units represent the inferior limit of the normal limit. For knowing the ability of the skin when it comes to protection, we measured the level of antioxidants, studying a group of 200 subjects of both sexes, with ages between 21 and 71 years old that were divided on age groups. At the same time, we made a comparative study correctly observing the variations and the evolution of the values of antioxidants.

The selection of the group used for the study was well structured, covering a different spectrum of the examined subjects, divided on sexes, age groups, origin environment, respectively urban and rural.

Table 1

Repartition on age groups, origin environment and sex of the examined subjects

No.	Age group	No. of subjects	Females	Males	Source environment	
					Urban	Rural
1	21-30	25	13	12	13	12
2	31-40	30	17	13	14	16
3	41-50	22	12	10	12	10
4	51-60	30	18	12	14	16
5	61-70	33	18	15	16	17
6	71 and over	46	24	22	20	26
<b>Total</b>		186	102	94	89	97



Fig. 1 – Left: Establishing the level of oxidants at the skin level with the biophotonic Scanner; Right: Diagram with the scale of values of the SCS score

## RESULTS AND DISCUSSION

During the study, by measuring the level of antioxidants from the surface of the skin, we obtained and identified the values of the level of antioxidants at the examined age groups. As a result of the investigations that were made, the study shows that the values of the antioxidants from the skin are situated, in case of all age groups, under 40.000 antioxidant units, value representing the inferior limit of the normal level of antioxidants. Slightly higher values were recorded in case of men, almost at all age groups, compared to women.

Chart no. 1

Average values of the level of antioxidants measured at the surface of the skin with the biophotonic Scanner at the examined age groups.

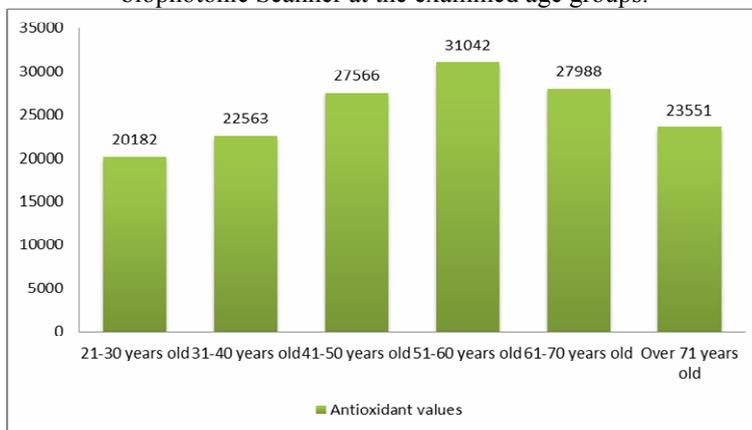


Chart no. 2

Average values of the level of antioxidants recorded in case of women

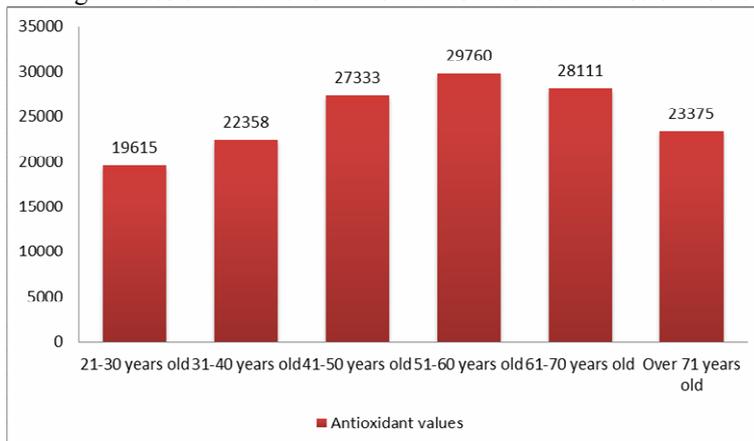
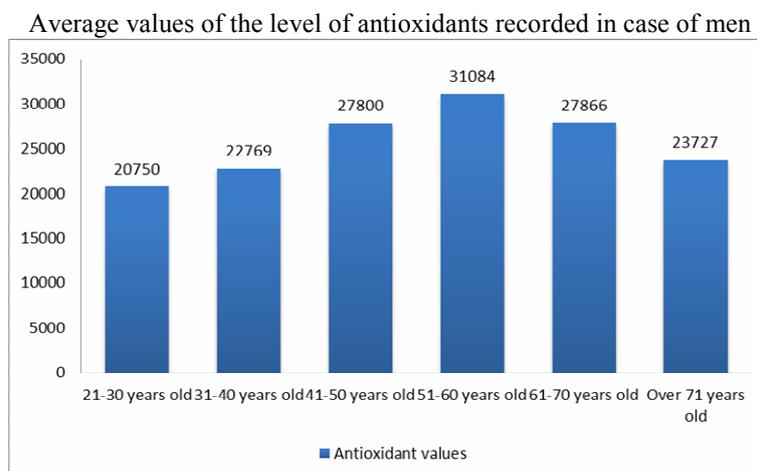


Chart no. 3



One of the most precise indicators of organism aging is skin. Skin aging is caused by two main factors that act simultaneously: an intrinsic factor and, the second one, an extrinsic factor. The intrinsic factor is, in fact, a physiologic process where heredity and the endocrine, hormonal factor play an important role. The extrinsic factor is given by the influence that the conditions of the external environment, the ambient has upon the skin and the organism, an important role being played by the ultraviolet solar radiations.

When the ultraviolet radiations of the sun touch the skin, they activate a molecule from the surface of the skin that produces a reaction when it comes in contact with the oxygen, forming atomic oxygen that may generate the production of free radicals. The free radicals have a destructive effect upon the tissues, producing numerous oxidative lesions and substantially accelerate the aging process.

The free radicals are very reactive forms of oxygen and are defined as being atoms or molecules with an odd electron. These molecules are extremely reactive, with a short duration of life, a great energetic and kinetic instability and make them “do anything” in order to become stable molecules. They obtain this either by giving up an electron or taking an electron from another molecule that becomes a free radical, a chain reaction being therefore the result. The free radicals produce, due to these chain reactions, the destruction of the cellular and extracellular components. The free radicals are produced in great quantities under the action of the solar beams, substantially accelerating the aging process; the best known free radicals are superoxide anion, the peroxide radical and the hydroxyl radical.

Against the attacks of the free radicals the organism has the ability to protect itself by generating certain antioxidants. Certain foods contain

antioxidants. So, antioxidants offer a natural primary protection against the aggression of the free radicals. When antioxidants come into contact with the free radicals, they assign them an electron neutralizing their deficit of electrons and stop the degenerative chain oxidation reaction caused by free radicals. That is why knowing of the level of antioxidants is important in order to know if an adequate antioxidant protection of the organism exists.

The cell is well equipped to deal with the oxidative stress, its integrity being maintained by enzymes like *glutathione reductase*, *catalase* and *glutathione peroxidase*. Among the non-enzymatic antioxidants that protect the skin are also included the glutathione and the ascorbic acid, vitamin E and the *quinone oil*.

The severity of the clinical and histological modifications caused at the skin level by the harmful action of the free radicals and that accelerate the skin aging varies considerably between individuals, for the antioxidant protection ability is different from individual to individual. This aspect also results from the study made by measuring the level of antioxidants in case of subjects that are different according to sex and age.

The SCS values are different and vary not only according to sex, but also from one group age to another. At the same time, the study accentuates the defective antioxidant protection in case of all the considered subjects. The values of the level of antioxidants are situated under the inferior limit of the normal limit, namely under 40.000 antioxidant units.

The lowest SCS value was recorded in case of age group 21-30 years old, where SCS = 20.182,69 antioxidant units.

There are a few differences between the sexes, SCS is higher among men, respectively 20.750 units, and among women the SCS = 19.615,38 units.

In case of age group 31-40 years old, the medium value of the level of antioxidants SCS = 22.563,58 units. A slightly growth is observed compared with the age group 21-30 years old.

In case of men, SCS = 22.769,23 compared to 22.258,94 units in case of women, so the differences between the sexes are maintained also in case of this group.

After 40 years old, the antioxidant score starts to grow, so in case of age group 41-50 years old a SCS = 27.566,66 was recorded, and in case of the next decade, respectively 51-60 years old, the value of the level of antioxidants grows to SCS = 31.042,16 units.

In case of women, there were recorded slightly lower values compared to men. Between 41-50 years old, SCS in case of women is 27.333,33, compared to 27.800 in case of men.

The researches show a small growth of SCS in case of adults up to 60 years old. After this age the values of the antioxidants begin to decrease again, so, in case of the subjects between 61-70 years old, SCS = 27.988,88 antioxidant units and in case of subjects over 71 years old there was recorded an average of the values of 23.551,13 units.

This age decade also indicates lower levels of antioxidants in case of men, SCS = 23.727,27, compared to the medium level in case of women, SCS = 23.375 antioxidant units.

Evaluating the values of the levels of antioxidants resulting from the study, one may observe that the antioxidant protection is low in case of all the studied subjects.

The lowest values were recorded in case of “extreme” groups, namely among young people and old people over 70 years old, these groups being generally known as being the most compromised groups.

One may say that the antioxidant protection is low in case of all the subjects, SCS being situated under the value of 30.000 antioxidant units, except for the age group 51-60 years old, where SCS = 31.042,16 units.

After 40 years old, the antioxidant protection grows up to around the age of 60-65 years old. After this age is observed again a diminution, once with the installation of complex modifications that take place in the organism and, partly, due to the aging phenomenon, when all the physiological processes suffer an involution process.

The antioxidant protection reflected by the levels of antioxidants differs, as one may observe from the researches made, from one individual to another, due to physiologic particularities of each organism, lifestyle, nutrition, pollution, the excessive exposure to solar radiations, the existence of some associated diseases and, last but not least, the hereditary factor. The last one determines the ability to assimilate antioxidants.

So, the results of the study, according to the measurements and evaluations made, highlights a low level of antioxidants at the skin and also at the organism level. This aspect shows the need of some measures for the growth and maintaining an optimal level of antioxidants, for the organism to deal with and annihilate the destructive, degenerative action of the free radicals and, therefore, to produce an amelioration of all the physiological processes, a regulation of the cellular activity and an improvement of the general state of the skin and organism.

The defensive power of the organism, the extension of longevity and the deceleration of the skin and organism aging process may be made by maintaining the antioxidant advantage, so keeping the free radicals under control.

This thing may be simply made by covering the need of antioxidants of the organism. The therapy with antioxidants, as well as an alimentation rich in antioxidants, helps the improvement of the functions of the organism and skin. And, while skin indicates the health of sickness level of the organism, an improvement of the clinical aspect of the skin is observed.

Skin, under the action of free radicals, generated by the solar radiations suffers numerous histologic modifications. The epidermis becomes thinner, emaciates and the dermis-epidermal junction flattens. The number of melanocytes decreases, but also their dimension decreases. The *melanocytes* are very important for the skin because they represent its main way of natural photoprotection. The number of *Langerhans cells* decreases. Cellular alterations, nuclear atypia and the decrease of the mitotic activity are other aspects that appear at the epidermis level.

Dermis is also modified. The collagen fibers get thinner, they become flat and their quantity and quality are reduced. The elastic fibers lose their elasticity, degrade and, in the end, skin is no longer elastic. The vascularization of the skin is modified by reducing the number of the vessels and their size.

All these morphological and structural modifications that take place in the skin, also determine modifications of its clinical aspect. Skin becomes laxer, thinner, loses its elasticity, resulting in folds and wrinkles, this way reflecting aging. The number and depth of wrinkles, the lack of tonicity, decrease of elasticity reflects its aging degree.

## CONCLUSIONS

- 1) The organism aging process is a complex, irreversible process.
- 2) Skin represents the most important clinical criterion regarding the aging degree.
- 3) The acceleration of the aging process and the highlighting of the cutaneous modifications are the result of the oxidative action of free radicals.
- 4) The antioxidants can defend the organism against the attack of free radicals.
- 5) The results of the study made by measuring the level of the antioxidants from the surface of the skin reflect their low level.
- 6) The decrease of the antioxidant protection mirrored in the low level of antioxidants show the detrimental effect of free radicals upon the skin and organism.
- 7) The therapy with antioxidants represents one of the most efficient methods of treatment when it comes to decelerating the aging process.
- 8) Keeping the free radicals under control by maintaining the antioxidant advantage decelerates the skin and organism aging process.

9) The formation, number and depth of wrinkles represent the most common clinical signs of cutaneous aging.

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