

# A new proposal for the evaluation of an antioxidant cosmeceutical in the treatment of the skin affected by the effects of urban life

*Uma nova proposta para avaliação de cosmecêutico antioxidante no tratamento da pele afetada pelos efeitos da vida urbana*

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## ABSTRACT

**Introduction:** Modern life in large urban centers exposes its residents to new factors related to extrinsic aging, such as pollution, poor diet and emotional stress. Treatments proposed for this cause of aging include the use of cosmeceutical products with antioxidant action.

**Objective:** To evaluate a formulation containing antioxidant substances in the treatment of skin affected by the effects of urban life.

**Methods:** Prospective clinical study evaluating 33 volunteers residing in urban centers. Clinical and instrumental measurements were carried out through the use of specific questionnaires and images captured using a VISIA device at baseline and twenty-eight days after using the product twice a day, in combination with sunscreen.

**Results:** The comparison of the data obtained from questionnaires applied in the initial and final visits showed a statistically significant improvement in most of the analyzed variables. There was a reduction of 15.78% in the extrinsic aging score. The image analysis demonstrated a statistically significant improvement ( $p < 0.05$ ) for the variables color uniformity and reduction of pores.

**Conclusions:** The use of the combination of active antioxidant substances led to an improvement in clinical and instrumental parameters of extrinsic aging caused by the phenomena linked to urban life ("urban damage"), arising as an alternative for this new indication.

**Keywords:** cosmetics; antioxidants; environmental pollution

## RESUMO

**Introdução:** A vida moderna nos grandes centros urbanos expõe seus moradores a novos fatores relacionados ao envelhecimento extrínseco, como a poluição, a dieta inadequada e o estresse emocional. Tratamentos propostos para esse padrão de envelhecimento incluem o uso de cosmecêuticos com ação antioxidante.

**Objetivo:** Avaliar uma formulação contendo antioxidantes no tratamento da pele contra os efeitos da vida urbana.

**Métodos:** Estudo clínico prospectivo, com avaliação de 33 voluntárias moradoras de centros urbanos. Medidas de avaliação clínica e instrumental, mediante a utilização de questionários específicos e imagens captadas pelo equipamento VISIA, foram realizadas nas visitas inicial e 28 dias após uso do produto aplicado duas vezes ao dia em associação à aplicação de fotoprotetor.

**Resultados:** As comparações dos dados obtidos nos questionários utilizados, nas visitas inicial e final demonstraram melhora estatisticamente significativa na maioria dos itens. Houve redução de 15,78% no escore de envelhecimento extrínseco. A análise das imagens demonstrou melhora estatisticamente significativa ( $p < 0,05$ ) para os itens "uniformidade de cor" e "redução de poros".

**Conclusões:** O uso da associação de ativos antioxidantes promoveu melhora nos parâmetros clínicos e instrumentais do envelhecimento extrínseco relacionado aos fenômenos envolvidos na vida urbana, denominados "danos urbanos", apresentando-se como alternativa para essa nova indicação.

**Palavras-chave:** cosméticos; antioxidantes; poluição ambiental

## INTRODUCTION

Aging is one of the most important subjects of contemporary medicine. This is due to the population's increasing life expectancy and, at the same time, the current search for ways to slow down the aging process.

When specifically referring to cutaneous aging, sunlight is recognized as the most important environmental factor, exerting oxidative action on the skin through solar radiation, particularly UV radiation.

More recently, however, science has been trying to evaluate other environmental factors (in addition to solar radiation) that can contribute to accelerate extrinsic cutaneous aging process.

Modern life, particularly in urban centers, offers a lifestyle that is considerably different from past ones, with exposure to new environmental factors, such as pollution, tobacco, unhealthy diet, emotional stress, irregular sleep and a fast pace of life.

This set of elements present in modern life in large urban centers, promoters of the phenomena related to aging in general – and particularly to skin aging – can be called “urban damage.”

For didactic purposes, the authors of the present study highlight three phenomena related to the urban damage that have been more intensely studied recently: environmental pollution, unhealthy diet and emotional stress.

### Environmental pollution and aging

The effects of pollution on human health have been studied for many years, in special regarding its effects on the cardiorespiratory system. It is known, however, that the skin – the largest organ in the human body and whose main characteristic is its interaction with the external environment – should also suffer the consequences of frequent contact with pollutants.

Based on data from an encompassing epidemiological study conducted in Germany, Vierkotter et al.<sup>1</sup> showed, in 2010, that chronic exposure to pollutants related to the traffic of automotive vehicles was significantly associated with the premature aging of the skin, becoming the first most apparent indication of the participation of pollution in the aging process. According to Vierkotter, the formation of pigmented lesions was the clearest clinical sign related to the exposure to pollution.

Despite their correlation with pollution being weaker than that of pigmentary lesions, melanoses (mainly located on the forehead, malar regions and on the hands' dorsa), findings with presence of seborrheic keratoses, telangiectasia, sagging and wrinkles were also considered.

An extensive epidemiological study (Taizhou) 2 was conducted with over 4,000 Chinese women, to investigate the influence of environmental factors (particularly pollution) and the signs of extrinsic aging in the Chinese population.

In addition, two other studies also conducted in China suggested the presence of correlation between deep wrinkles and fossil fuels in cooks working with fossil fuels.<sup>3,4</sup>

The mechanism by which pollutants trigger the aging process is not yet fully understood, nonetheless the model presented by Krutman et al. 2 in 2014 is the most widely accepted to date.

Particulate matter (PM) and ozone (generated by the reaction of volatile organic compounds with solar radiation) have important roles in this model, determining a set of changes in the skin barrier and the activation of receptors and cytokines, which will, at the end of the process, activate clinical alterations manifested in extrinsic aging.

It remains unclear whether the particulate matter (PM) is able to trigger oxidative stress on its own. However, it is known that these particles are carriers of organic chemical compounds, such as polyaromatic hydrocarbons (PAHs), which are highly lipolytic compounds that easily penetrate the skin.

Two other studies<sup>5,6</sup> found a strong association between premature skin aging and exposure to soot, a mixture of carbon particles coated with PAHs.

Polyaromatic hydrocarbons are potent ligands for the AhR (Aryl hydrocarbon Receptor), which is a transcription factor expressed in keratinocytes and melanocytes.

The AhR is a protein complex present in cytoplasm of all vertebrate cells. Its primary function is the participation in the metabolism of external chemical agents such as dioxins, the PAHs and their related compounds.

After activation, the AhR migrates to the cell's nucleus, binding to the DNA's XRE sequence and triggering a transcriptional process, with the generation of reactive oxygen species and activation of proinflammatory and pro-melanogenic cytokines, interfering in the aging and pigmentation processes, with the onset of dermatoses, such as sensitive skin, atopic dermatitis and also carcinogenesis process.

The ozone produced in the atmosphere (resulting from the action of environmental pollutants in contact with sunlight – not to be confounded with the ozone in the stratosphere, which is able to filter radiation such as UVC – does not act directly in the viable skin, however can trigger oxidative stress, including depletion of the vitamins C and E, as well as lipid peroxidation of membranes in the presence of malondialdehyde (MDA).

In addition to participating in the extrinsic aging process, pollution seems to be closely related to the development of sensitive skin.<sup>7-10</sup> Although it is not directly related to the aging process, patients with sensitive skin become more prone to early development of aging, due to the chronic inflammation established in the skin.

### Poor diet and the glycation phenomenon

Another phenomenon observed in modern life is poor diet. Food high in carbohydrates and saturated fats in addition to the excessive consumption of fried food, rather than cooked or grilled dishes, are typical examples of the diet in major urban centers.

The relationship between poor diet and aging seems to be explained by the glycation phenomenon.

Glycation is the non-enzymatic reaction between reducing sugars (such as glucose) and proteins, lipids or nucleic acids. This reaction results in the formation substances known as AGEs (Advanced Glycation End products).<sup>11</sup>

The AGEs may be endogenously produced or acquired by diet,<sup>11</sup> and its excessive deposition in tissues is implied in diseases related to aging and diabetes, such as diabetic angiopathy, macular retinal degeneration and osteoarthritis.

The skin is an organ where AGEs are deposited, and the phenomenon has been studied not only in cases of diabetes but also regarding the aging process. The presence of autofluorescence in the AGEs has been linked to chronological aging in different studies.<sup>12,13</sup>

### **Emotional stress and skin aging**

One of the characteristics of modern urban life is the constant emotional stress to which individuals are subjected.

Emotional stress affects the physical and psychological health, interfering with the homeostasis of different organs – the skin among them – also being implicated as an accelerating factor of aging of the body as a whole and, in particular, of the skin.<sup>14</sup>

The activation of hormones involved in the biological response to stress (sympathetic and parasympathetic systems and adrenocortical axis, for instance) ends up interfering with cell homeostasis, generating a greater amount of reactive oxygen species (ROS), which will, as it is already known, interfere with the collagen's and extracellular matrix's production/destruction balance, and influence the melanocytes' activity, resulting in the acceleration of the aging process.<sup>14</sup>

### **Strategies to reduce the damage cause by urban life**

Prevention of the aging resulting from urban life requires that some actions be taken in order to improve the quality of life. These are preventive and remedial measures based on the use of cosmeceuticals and nutraceuticals, isolatedly or combined.

New active principles have been proposed that are capable of reducing the damage triggered by pollution, AGEs (glycation) and emotional stress, through different mechanisms (competing mechanisms on specific receptors, antioxidant action, reduction of generation or elimination of the already formed AGEs).

Some products based on antioxidant technologies, are proposed to be used isolatedly or in combination with other products, aiming at reducing symptoms and signs related to extrinsic aging, and promoting improvement in the perception of the skin's quality by individuals exposed to urban damage.

### **Resveratrol**

Among the proposed new active principles is resveratrol. An extensive review study<sup>15</sup> discusses the benefits of this phenolic derivative – namely its antioxidant activity, particularly emphasized in the prevention of the aging process – in diverse dermatologic conditions. The authors emphasize that the use of resveratrol microspheres contributes to improved stability of the formulation and provides sustained delivery of the active principle to the skin.

In an *in vitro* study with fibroblast culture, a combination of resveratrol with other active antioxidants has proven effective in the inhibition of nuclear translocation of AhR, thus preventing the activation of the genes responsible for the damaging effects of pollution (in this case assessed using cigarette smoke).<sup>16</sup>

The purpose of the present study was to evaluate the efficacy of a new cosmeceutical substance with antioxidant action in the prevention of the effects of damages caused by urban life.

The study's quantitative analysis was challenging and specific questionnaires were used to evaluate the patients' quality of life (adapted to the urban damage). In addition the SCINEXA questionnaire, developed and validated for analysis of the extrinsic aging specifically related to environmental pollution, was applied. Furthermore, instrumental assessments based on the capture of images were carried out aimed at complementing the study's assessment.

## **METHODS**

### **Study design**

A clinical, open and monadic study was carried out with the assistance of clinical and instrumental evaluations.

### **Studied population**

Thirty female volunteers were recruited and selected (25 to 55 years of age, complete secondary education, living in urban areas, with the self-perception of having been living a stressed life, with inadequate sleeping and eating habits).

The study was conducted at the Medcin Instituto da Pele, a private practice specializing in dermatology, in accordance with the Good Clinical Practice principles and the Brazilian National Health Council's Resolution 466 (December 12, 2012). In addition, the study protocol was previously analyzed and approved by an independent Research Ethics Committee.

### **Procedures**

On the first visit, after having signed the Free and Informed Term of Consent, each volunteer underwent an initial dermatologic evaluation aimed at checking the inclusion/exclusion criteria.

Two questionnaires, which will be detailed in the next section, were applied to assess the effects of pollution/urban life.

After clinical assessment, the volunteers underwent photographic record of the neck region with the Visia device (Canfield Imaging Systems).

The volunteers then received three products to use at home: a neutral cleanser, a standardized SPF 30 sunscreen, and the test-product.

After 28 days of use, the volunteers returned for the final evaluation, with the application of the same questionnaires applied in the initial visit and the capture of images using the VISIA device.

### **Questionnaires**

The clinical evaluation of the intrinsic and extrinsic aging, termed SCINEXA, was validated by Vierkötter et al. in 2009,<sup>17</sup> as a noninvasive clinical scoring method to assess the skin aging that takes into account both intrinsic and extrinsic factors. Using 5 parameters indicative of intrinsic aging and 18 parameters characteristic of extrinsic aging, this scale allowed the differentiation between intrinsic and extrinsic cutaneous aging.

In 2010, Vierkötter et al. 1 presented a modified score for SCINEXA, in which the extrinsic cutaneous aging was represented by *Pigmented spots, deep wrinkles, solar elastosis and telangiectasia*, while *sagging and seborrheic keratosis* were parameters of intrinsic cutaneous aging. Based on the existing number of lesions, the following scores were attributed: 0 (absence of pigmented spots or seborrheic keratosis, for – extrinsic and intrinsic aging, respectively); 5 (presence of 1 to 10 spots or seborrheic keratosis); 30 (presence of 11 to 50 spots); and 75 (presence of more than 50 spots or seborrheic keratosis).

Deep wrinkles, telangiectasia and sagging were scored with 0 (absent) to 5 (very intense presence of signs). Solar elastosis was assessed as existent (yes) or non-existent (no).

Chart 1 shows the modified SCINEXA scale, as proposed by Vierkötter.<sup>1</sup>

For the evaluation of the quality of urban life, a five-point scale questionnaire was applied based on a variation of the CosmeceutiQol questionnaire, 18 developed and validated for the assessment of cosmeceutical products used to improve the quality of life of users.

For the present study, some questions were adjusted to specifically assess the effectiveness of a cosmeceutical in the improvement in the quality of urban life (Chart 2).

**Image-based quantitative analysis**

VISIA® Complexion Analysis (Canfield)

The equipment uses digital technology and ultraviolet lighting to photograph the most superficial layers of the face.

Based on these images, a software runs a detailed analysis of the conditions of the skin. In the present study, the device performed the analysis of pore count and color uniformity in all experimental timepoints. The captured images were analyzed using the ImagePro software.

**RESULTS**

**A - Clinical efficacy**

Thirty-five volunteers were evaluated, with the inclusion of 33 of them. One did not return for the final evaluation. It was not possible to verify the reason for the non-attendance, with the event being therefore classified as a loss of follow up. Thirty-two volunteers completed the study, with absence of reactions referred or observed in the body site evaluated.

**EVALUATION OF THE URBAN QUALITY OF LIFE**

In order to evaluate the quality of urban life, the volunteers were asked to express their opinions regarding the conditions of the skin at the time of evaluation, which took place before the application of the products (D0) and 28 days after continuous use (D28).

The analysis of the data obtained was performed considering the descriptive data, mean values, statistical test (Student t-test) and percentage of improvement.

Table 1 shows the results the questionnaire assessing the quality of life.

CHART 1: Modified SCINEXA scale <sup>1</sup>		
Signs of skin aging	Location	Scale
<b>Extrinsic signs</b>		
Pigmented spots <sup>1</sup> (solar melanosis)	Forehead	( ) 0 ( ) 1-10 ( ) 11-50 ( ) > 50
	Malar	( ) 0 ( ) 1-10 ( ) 11-50 ( ) > 50
Deep wrinkles <sup>2</sup>	Fronte	( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
Periorbital regions		( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
Subpalpebral regions		( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
Upper lip		( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
Nasolabial fold		( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
Solar elastosis	Malar	( ) Yes ( ) No
Telangiectasia	Malar	( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
<b>Intrinsic signs</b>		
Flacidez <sup>2</sup>	Inversion of the facial youth triangle	( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
Seborrheic keratosis	Upper body	( ) 0 ( ) 1-10 ( ) 11-50 ( ) > 50

<sup>1</sup> Escala para manchas de pigmentação e queratose seborreica possui graduação (em parênteses) de acordo com o valor escolhido – 0 (0), 1-10 (5), 11-50 (30), > 50 (75) = 1 The scale for pigmented spots and seborrheic keratosis has a gradation (in brackets) according to the value chosen: 0 (0), 1-10 (5), 11-50 (30), > 50 (75).

<sup>2</sup> Graduação com escala fotográfica, em que 0 = sem presença de sinais e 5 = presença muito severa de sinais = 2 Gradation with photographic scale, where 0 = absence of signs, and 5 = very intense presence of signs.

CHART 2: Quality of urban life questionnaire

The following questions refer to the volunteer's skin and how he or she feels today, and only today	Yes, absolutely	Yes	Yes, a little	No, in any way
Choose the best answer for each question, marking it with an "X"	(5)	(4)	(3)	(2) (1)
Today my skin has few spots and a more uniform color				
Today my skin is fair in color (less reddish)				
Today my skin is more resistant (less sensitive), and endures better the effects of pollution				
Today I feel my skin is smooth, with less fine lines				
Today I feel my skin is hydrated				
Today I feel my skin is clean				
Today I feel my skin is rejuvenated				
Today my skin feels smooth to the touch				
Today I feel my skin is fresh				
Today I feel my skin is toned				
Today I feel my skin is bright, radiant				
Today I feel my skin is restored and not fatigued				
Today I feel my skin is revitalized				

### THE SIGNS OF CUTANEOUS AGING (SCINEXA SCALE)

In order to evaluate the signs of cutaneous aging the SCINEXA scale was applied, according to which the researcher physician evaluated the extrinsic and intrinsic signs prior to the application of the products (D0) and 28 days after their continued use (D28).

The analysis of the data obtained was performed taking into account descriptive data, mean values, statistical test (Student t-test) and percentage of reduction of the cutaneous signs of aging.

Table 2 presents the descriptive data of the parameters evaluated using the SCINEXA scale.

Graph 1 depicts the improvement in the score of extrinsic signals after 30 days of test-product use.

### SKIN UNIFORMITY EFFECTIVENESS AND PORES' SIZE EVALUATION

Photographs taken before the application (D0) and 28 days after continued use (D28) assisted in the evaluation of the effectiveness of the skin's uniformity and the pores' size. The analysis of the images was performed using the software Image Pro® Plus 6.0, with the subsequent analysis of the data obtained being carried out with the statistical software SPSS version 21.

In the statistical analysis, the paired t-test was used for the comparison of data originary from the same volunteer on the experimental timepoints, with a significance level of 95% ( $p < 0.05$ ).

Table 3 shows the results of the instrumental evaluations for color uniformity and pores' size.

It was possible to observe that there was a statistically significant reduction in the coefficient of variation of the skin's color, meaning that the skin's color became more uniform. It

TABLE 1: Quality of life questionnaire: results on the initial and final visits

Question	Mean value on T0	Mean value on T28	Difference between the mean values (%)	p value
Today my skin has few spots and a more uniform color	3,53	3,94	11,50	0,062**
Today my skin is fair in color (less reddish)	3,91	3,88	- 0,80	0,902
Today my skin is more resistant (less sensitive), and endures better the effects of pollution	3	4,19	39,58	< 0,001*
Today I feel my skin is smooth, with less fine lines	3,09	3,84	24,24	0,006*
Today I feel my skin is hydrated	3	4,19	39,58	< 0,001*
Today I feel my skin is clean	3,59	4,13	14,78	0,0024*
Today I feel my skin is rejuvenated	3,38	3,88	14,81	0,125
Today my skin feels smooth to the touch	3,03	4,13	36,08	0,001*
Today I feel my skin is fresh	3,09	4,22	36,36	< 0,001*
Today I feel my skin is toned	2,81	4,16	47,78	< 0,001*
Today I feel my skin is bright, radiant	2,75	3,78	37,50	0,002*
Today I feel my skin is restored and not fatigued	2,75	3,91	42,05	< 0,001*
Today I feel my skin is invigorated	2,97	4,09	37,89	< 0,001*

/ \* = significant at a 5% level

\*\* = significant at a 15% level

could also be observed that there was a statistical significant average reduction in the pores' size.

## DISCUSSION

The aging of the world population is one of the most important phenomena of the 21<sup>st</sup> century, having become the subject of interest and concern from different segments of the society.

In dermatology, this has translated into a concern for the physical well being, associated with a young and healthy appearance, which is a frequent request of patients in dermatologic practices. As a result, the understanding of the phenomena involved in the aging process, as well as actions aimed at preventing and treating it, are essential chapters in modern dermatology practice.

The events linked to chronological aging (intrinsic) and, in special, to photoaging, are better known and studied. The daily use of measures of protection against sunlight, particularly the use of sunscreens, is widely recognized as a crucial measure in an aging prevention program.

More recently, however, investigators have sought to assess the impact of other extrinsic factors in the aging process.

Among these factors, the phenomena inherent to modern urban life – pollution, emotional stress and poor diet – are the most frequently studied. This set of phenomena is generically termed “urban damage”, and the demand for mechanisms to prevent it has also been of interest to researchers.

The generation of reactive oxygen species is common all the mentioned phenomena, meaning that cosmeceutical products containing specific antioxidant active principles are instrumental for the concept of prevention of urban damage.

The present study has evaluated a new cosmeceutical containing active principles with recognized antioxidant action, such resveratrol microspheres combined to caffeic and ferulic acids, and blueberry extract, whose therapeutic proposal is to prevent urban damage.

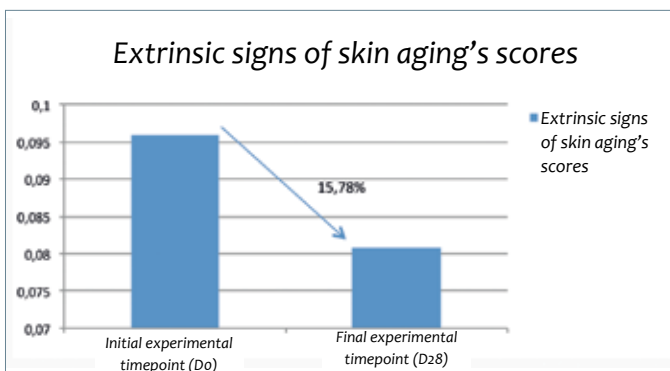
The present study has evaluated 33 volunteers living in urban areas and whose life style demands exposure to the unwholesome factors of modern life in large cities, such as accelerated pace of life, continued stress and inadequate nutrition.

The selected evaluation criteria were the use of a questionnaire about the quality of life and use of the cosmeceutical product 18 (adjusted to the urban damage criteria), a second

TABELA 2: DESCRIPTIVE DATA OF THE PARAMETERS EVALUATED BY THE SCINEXA SCALE ON THE INITIAL AND FINAL VISITS

Extrinsic signs of skin aging							
Signs	Location	Média				Variation Do x D28	p value (Do x D28)
		To	Stdev	T28	Stdev		
Pigmentation spots (solar melanosis)	Face	5,63	14,63	4,69	13,97	- 16,67%	0,245
Deep wrinkles <sup>2</sup>	Malar	9,53	15,68	7,53	14,90	- 20,98%	0,077**
	Face	1,16	1,30	1,03	1,26	- 10,81%	0,161
	Periorbital regions	0,91	1,17	0,84	1,08	- 6,90%	0,423
	Subpalpebral regions	0,84	1,30	0,81	1,26	- 3,70%	0,745
	Upper lip	0,72	1,02	0,63	0,91	- 13,04%	0,184
Solar elastosis	Nasolabial sulcus	1,47	1,37	1,44	1,27	- 2,13%	0,768
	Malar	1,56	0,50	1,56	0,50	0,00%	-
Telangiectasia	Malar	0,22	0,42	0,19	0,40	- 14,29%	0,325
<b>Extrinsic signs scores</b>	0,10	0,14	0,08	0,12	- 15,78%	0,147	
Intrinsic signs of skin aging							
Signs	Location	Mean values				Variation Do x D28	p value (Do x D28)
		To	Stdev	T28	Stdev		
Sagging <sup>2</sup>	Inversion of the facial triangle of youth	1,03	1,20	0,94	1,11	- 9,09%	0,184
Seborrheic keratosis <sup>1</sup>	In the upper part of the body	0,31	1,23	0,31	1,23	0,00%	-
<b>Intrinsic signs scores</b>		0,02	0,02	0,02	0,02	- 6,98%	0,184

\*\* = significant at a 10% level



GRAPH 1: Average scores of the skin's extrinsic aging at baseline and final experimental time point

questionnaire evaluating the extrinsic aging 1, 17 (already described and previously validated for use in a study on the effects of pollution on the skin) and two instrumental criteria based on the assessment of images regarding the skin's color uniformity and quantity of pores.

Regarding the questionnaire aimed at assessing the quality of life, the authors verified that most of the variables (10 from 13) had a statistically significant improvement after 28 days use of the product. The data demonstrated that the product's use offered some kind of benefit, improving the volunteers' perception regarding the quality of their skin.

Observing the data drawn from the SCINEXA questionnaire for the evaluation of clinical signs resulting from extrinsic aging, it was possible to observe an improvement in the evaluated variables, except for "seborrheic keratosis" and "solar elastosis".

Yet, only one of them ("melanosis in the malar region") had improvement with some degree of statistical significance ( $p < 0.1$ ).

Due to the fact that the presence of melanosis, keratosis, deep wrinkles and telangiectasia are well-established clinical signs, the SCINEXA scale determines a very strict assessment for the proposal of use of an antioxidant product for 28 days. Notwithstanding, it is important to note that the 15.35% improvement in the extrinsic aging score can be considered very relevant due to the short period of use.

TABLE 3: Results of the instrumental measurements of color and pores

Measure	Initial experimental timepoint	Final experimental timepoint	Change (%)	Statistical significance (p < 0,05)
Skin color variation coefficient (%)	6,56	6,27	- 4,42	Sim
Average size of pores (pixels)	32,6	31	- 4,9	Sim

Regarding the image based evaluation; a statistically significant improvement was detected in the skin's color uniformity and presence/intensity of pores, meaning that the test product was capable of promoting a whitening effect by reducing the heterogeneous pigmentation of the aged skin. The product also had the effect of reducing the number of "pores", corresponding to an additional benefit noticed by the patients, especially due to the link existing between the presence of "pores" and dirt on the skin.

## CONCLUSION

The continued use for 28 days of a new cosmeceutical product containing active principles with recognized antioxidant action led to positive outcomes in volunteers exposed to the so-called "urban damage" phenomena. As a result, there was a reduction in the signs and symptoms related to extrinsic aging, promotion of the skin's uniformity and reduction of pores, with a contribution to the perception of improvement in the quality of life of individuals exposed to the phenomena of modern urban life. ●



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