

# SKIN AND AGEING: A MORPHO-SPECTROMETRIC STUDY

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## Synopsis

Ageing is a complex process influenced and determined by genetic, constitutional and environmental factors. In order to evaluate whether skin aging alterations are accompanied by a change in the chemical composition of the cutaneous tissue, we studied 8 patients. A sample of actinically damaged skin was taken from each patient. The specimens were analyzed under a Philips XL20 scanning electron microscope connected to an dispersive energy spectrometer. A semiquantitative analysis was carried out by x-ray spectroscopy considering only the value of  $K\alpha$  and  $L\alpha$  of each element and elaborating the data by ZAF correction method. The analysed elements were: Na, K, S, Ca, P, Zn, Mg. Our results showed that in old people there is a tendency to have elevated values for all the elements considered except for 3 parameters: P, Ca and Mg which result decreased. The work represent a new attempt to face the study of skin, from this analysis suggestive information emerged on the structural change in the aged skin which further underlines the importance of elements' microenvironment in senescence processes.

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## Riassunto

L'invecchiamento é un processo complesso che viene influenzato e determinato da fattori genetici, costituzionali ed ambientali. Per valutare se le modificazioni morfo-strutturali della cute senile si accompagnano ad una variazione della composizione chimica del tessuto cutaneo, é stato condotto uno studio mediante un microscopio elettronico a scansione collegato ad uno spettroscopio a raggi X. Gli elementi studiati con questa analisi semiquantitativa sono stati: Na, K, Ca, S, P, Zn, Mg, al fine di meglio comprendere l'importanza del microambiente nei processi di invecchiamento.

## INTRODUCTION

Ageing is a complex process influenced and determined by genetic, constitutional and environmental factors. The majority of Authors agree on the importance of the prolonged action of external factors (such as solar exposition) in the ageing of the skin: the histological alterations in the areas exposed to the sun are much more evident even if they differ, at least partly, from those in areas not exposed.

In order to evaluate whether these aging alterations are accompanied by a change in the chemical composition of the cutaneous tissue, we studied 8 patients (4 aged under 30 years, 4 aged over 60 years)

## MATERIALS AND METHODS

A sample of actinically damaged skin was taken from each patient. The specimens were fixed in 2% glutaraldehyde in 0.1% cacodilate buffer, dehydrated in ethanol concentration and subjected to a critical point drying using CO<sub>2</sub>, set on suitable carbon-covered supports with a conductive glue and then covered in a 50 nm thick layer of carbon. The samples were studied using a Philips XL20 scanning electron microscope connected to an energy dispersive spectrometer. The semiquantitative analysis was carried out keeping certain parameters constant: voltage 25 kV, magnification 400x, spot size 1 nm, counting rate not under 2000 CPS (Counts Per Seconds), take off angle 15°, life time 600". Only the value of K $\alpha$  and L $\alpha$  of each element were considered and elaborated using the ZAF correction method which considers the atomic -Z number, the absorption-A and the fluorescence-F. For each patient two analyses were effected at the epidermal level, two at the superficial dermal level and two at the deep dermal level. The studied elements were: sodium, potassium, sulphur, phosphorus and calcium among the plastic primary elements and zinc and magnesium among the oligoelements.

## RESULTS

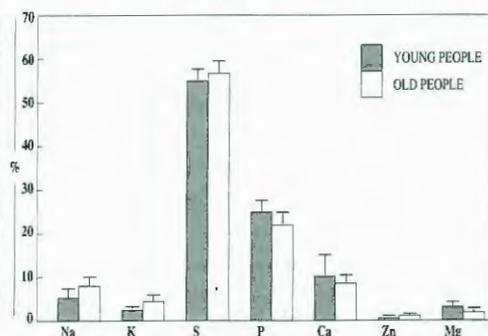
**Table n°1**

**TOTAL VALUES OF THE SKIN**

	JOUNG PEOPLE	OLD PEOPLE
Na	5.09±2.10	8.25±1.9
K	2.04±0.64	4.08±1.13
S	55.85±3.32	57.58±3.48
P	25.14±2.58	21.41±3.95
Ca	10.76±5.12	9.32±2.04
Zn	0.38±0.08	0.60±0.17
Mg	2.45±1.00	1.46±0.74

**Table n°II**

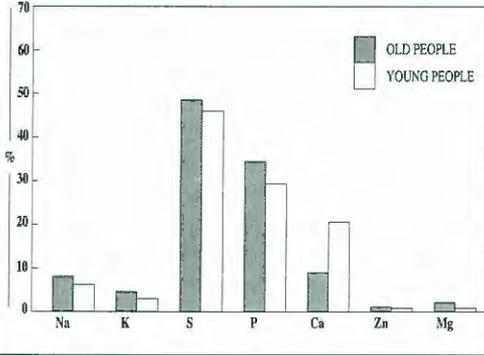
**PER CENT COMPOSITION RELATED TO THE SKIN**  
(MEAN VALUE AND STANDARD ERROR)



The data reported in table n. I and in table n. II show that in old people there is a tendency to have elevated values for all the elements evaluated, except for 3 parameters: phosphorus, calcium, and magnesium which result decreased. Table n. III, IV, V show the values obtained for single parameters in young and old people respectively at the epidermal level, superficial dermal level and deep dermal level.

**Table n°III**

PER CENT COMPOSITION RELATED TO THE EPITHELIAL LEVEL  
(MEAN VALUE)

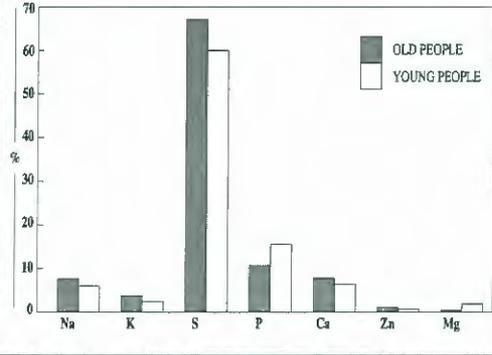


Studing table n. III we notice that in aged people there is an increase of Na, K, S, P, Zn, Mg and a decrease of Ca at the epidermal level.

The concentration of elements found at the superficial dermal level shows the same trend noticed before: the values obtained in old people are higher except for S and P which decreased table n.IV), while P and Mg are decreased in the deep dermal level of aged patients (table n.V).

**Table n°V**

PER CENT COMPOSITION RELATED TO DEEP DERMAL LEVEL  
(MEAN VALUE)



## DISCUSSION

As far as morphology and the deepness of skin in young and old people is concerned, some Authors found as the epidermis of old people exhibits a marked variation in thickness and a disparity in the size, shape and staining quality of the basal cell nuclei.

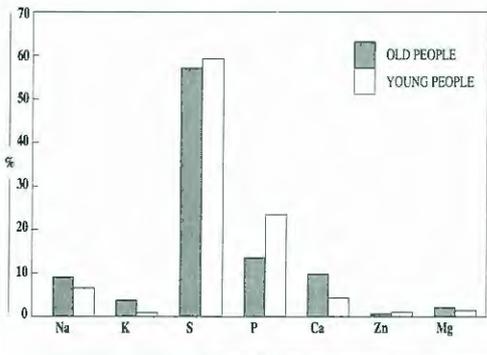
There is a loss of the orderly alignment of cells along the basement membrane and a disruption of the gradual upward uniform differentiation present in the epidermis from younger individuals (1). The dermis of aged people seem thinner and present a lower number of cells. Despite substantial anatomic, biochemical and biomechanical studies that many Authors have done, we are still far from a consensus regarding age-associated alterations in the dermis (1).

As far as the study of the skin from a chemical point of view is concerned the decrease in total water content has always been considered one of the most important features of aged skin.

Certain analysis carried out by various Authors using RMN *in vivo*, have however shown an increase in free water in the aged skin, especially at the superior dermal level (2, 3). Moreover these Authors noticed an increase in total water contents in aged skin and a decrease of collagen amount and of proteoglycans. This last datum

**Table n°IV**

PER CENT COMPOSITION RELATED TO SUPERFICIAL DERMAL LEVEL  
(MEAN VALUE)



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