

## THE EFFECT OF GELATIN-GLYCINE ON SKIN HYDRATION.

(1) Morganti P., (2) James B. and (3) Randazzo S.D.

(1) President /Director Research & Development, Mavi sud s.r.l. - Aprilia (LT) Italy

(2) Program Director International Society of Cosmetic Dermatology - James Clinic - Perrysburgh (Ohio) USA

(3) Professor of Experimental Dermatology University of Catania (Italy).

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### Synopsis

The water content of stratum corneum is of great importance in maintaining the skin flexibility. Skin chapping, cracking and scaling I thought to be the result of a low water content in the SC. The SC either loses or absorbs water from its environment depending upon certain of its own internal material, the normal moisturizing factors (NMF), the temperature and the relative humidity of the atmosphere.

Our previously obtained data indicates that the levels of Pyrrolidone Carboxylic Acid (PCA) in the SC may be directly affected by oral administration of gelatin-glycine.

The results presented here confirm our previous investigation. The oral administration of gelatin-glycine seems to exert an interesting moisturizing action, influencing the extensibility (Tab. 1,5), the water content (Tab. 2,4) and the level of PCA of SC both in guinea-pigs and in human skin.

On the basis of this study, treatment by oral gelatin-glycine would seem to be useful complement to cosmetic use for dry and aged skin.

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### Riassunto

L'acqua presente a livello dello strato corneo è fondamentale per mantenere la cute morbida ed idratata.

La perdita anche di una piccola quantità di tale acqua si traduce subito in secchezza della pelle con comparsa anche di fessurazioni. Lo strato corneo perde o assorbe acqua dall'ambiente anche in dipendenza della quantità di NMF presente tra le tegole cheratiniche.

I risultati ottenuti con questo studio confermano i nostri precedenti dati. La somministrazione anche della gelatina Gelatina-Glicina sembra esercitare un'interessante attività idratante a livello cutaneo influenzando l'elasticità, il contenuto di acqua e il livello di PCA dello strato corneo sia negli animali che nell'uomo. Sulla base di questo studio sembra possa affermarsi che la somministrazione orale di gelatina-glicina può essere considerata un utile complemento all'uso dei cosmetici per la pelle secca ed invecchiata.

## Introduction

A dry, inflexible, cornified epithelium results from an excessive loss of water. The water content of stratum corneum (SC) is of great importance in maintaining the skin flexibility (1). Skin chapping, cracking and scaling is thought to be the result of a low water content in the SC. The SC either loses or absorbs water from its environment depending upon certain of its own internal material (2), the normal moisturizing factors (NMF), the temperature and the relative humidity of the atmosphere (3,4).

Our previously obtained data indicates that the levels of Pyrrolidone Carboxylic Acid (PCA) (one of the most effective naturally occurring humectants in NMF) in the SC may be directly affected by oral administration of gelatin-glycine (5,6).

The objective of this study was to determine the influence of the gelatin-glycine on the biomechanical properties of normal SC and attempt to relate these to the amount of waters and PCA recorded.

## Methods

The studies, in guinea-pigs and in women, were carried out using pills (QM)\* containing each one Gelatin-glycine (Gelatin 150 mg - Glycine 75 mg) together with some vitamins (Vit B6, 0,2 mg; Vit. C, 5 mg; and minerals, Mn++0,25 mg; Cu++0,3 mg; Fe++1,5 mg and Ca++20 mg. As a control, pills were used containing gelatin and starch only.

## Evaluation in guinea-pigs

60 male albino guinea-pigs were employed of the average weight of 400 g±20. 10 guinea-pigs were kept on a gelatin-glycine diet for 90 days,

while the remaining 10 served as control.

The diet was administered weekly in the cage and in accurately weight quantity so that the guinea-pigs, kept in single cages, would ingest together with the feed 105 mg per kg a week of gelatin-glycine mixture (Product QM).

## Water content and extensibility of stratum corneum in guinea-pigs

The SC for the experiments was obtained (61st day) from the hind footpads of the two groups of guinea-pigs. The whole footpads were incubated for 18hr at 37°C in a solution containing 2M urea, 0,5% trypsin and 0,1M tris buffer, pH 7,4 (3). The rectangular (0,6x1,5 cm) separated corneum pieces (two for each animal) were equilibrated in atmospheres of controlled humidity prior to measuring extensibility and water content (RH 81%).

\* trade name QUICK MOIST

## Measurement of extensibility

The extensibility of the strips of SC measured on an Instron Tester (3).

At the start of the experiment the jaws were 0,5 cm apart and the corneum strip (1,5 cmx0,6 cm) was stretched to a length of 0,75 cm at a constant rate of extension of 0,5 per min. The force required for this extension was measured with a tension cell and automatically recorded.

RH was 81% at 22°C. The extensibility is expressed as the percentage extension per 100 g load.

The obtained values are shown in Fig. 1.

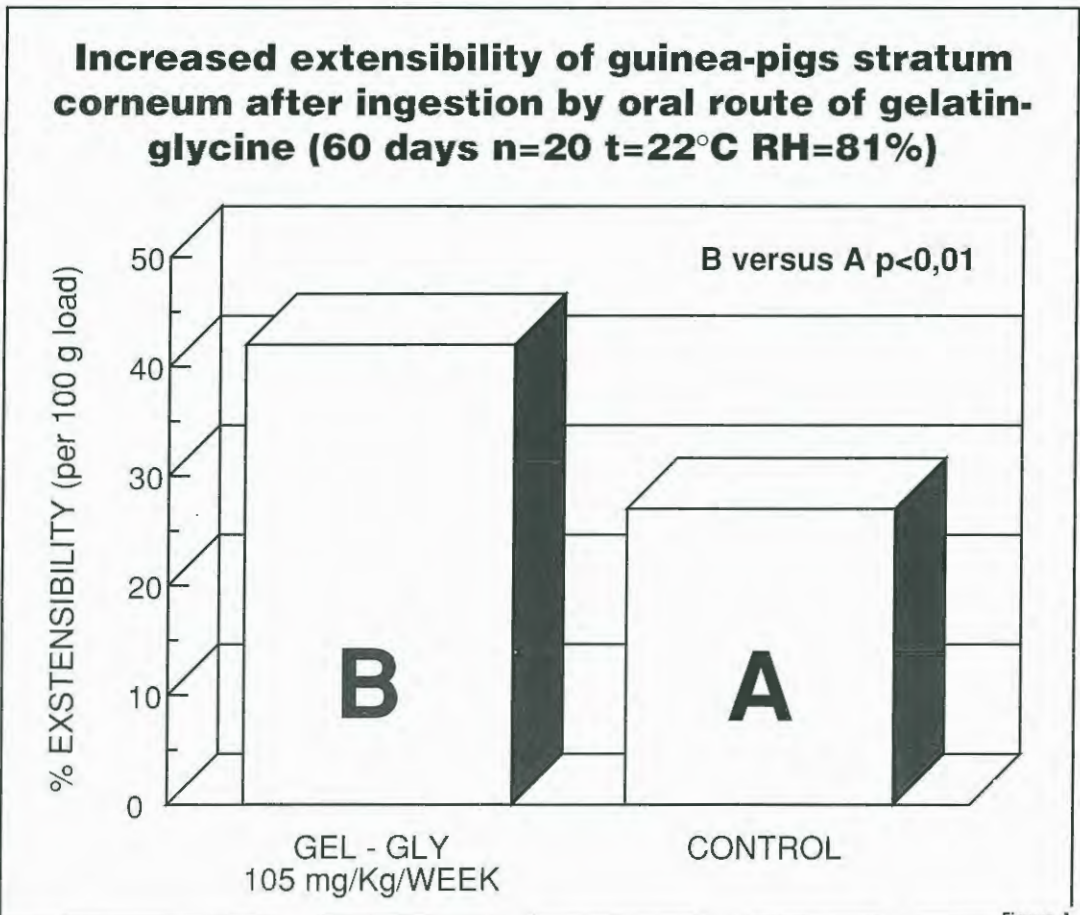


Figure 1

### Measurement of water content

The water content of SC (pieces of 20-40 mg) was measured by equilibrating in an atmosphere of constant relative humidity (RH 81%) weighing, and comparing this with the dry weight following the method of Middleton. The SC was suspended on hooks over saturated potassium bromide solution at 81% RH in small

crew-capped bottles. After 6 days equilibration SC was weighted to obtain a wet weight.

After a further 6 days equilibration over a mixture of molecular sieve and self-indicating silica gel a dry weight was obtained. From the wet and dry weights the water content was calculated, expressed as mg water content per 100 mg dry corneum. The obtained values are shown in Fig. 2.

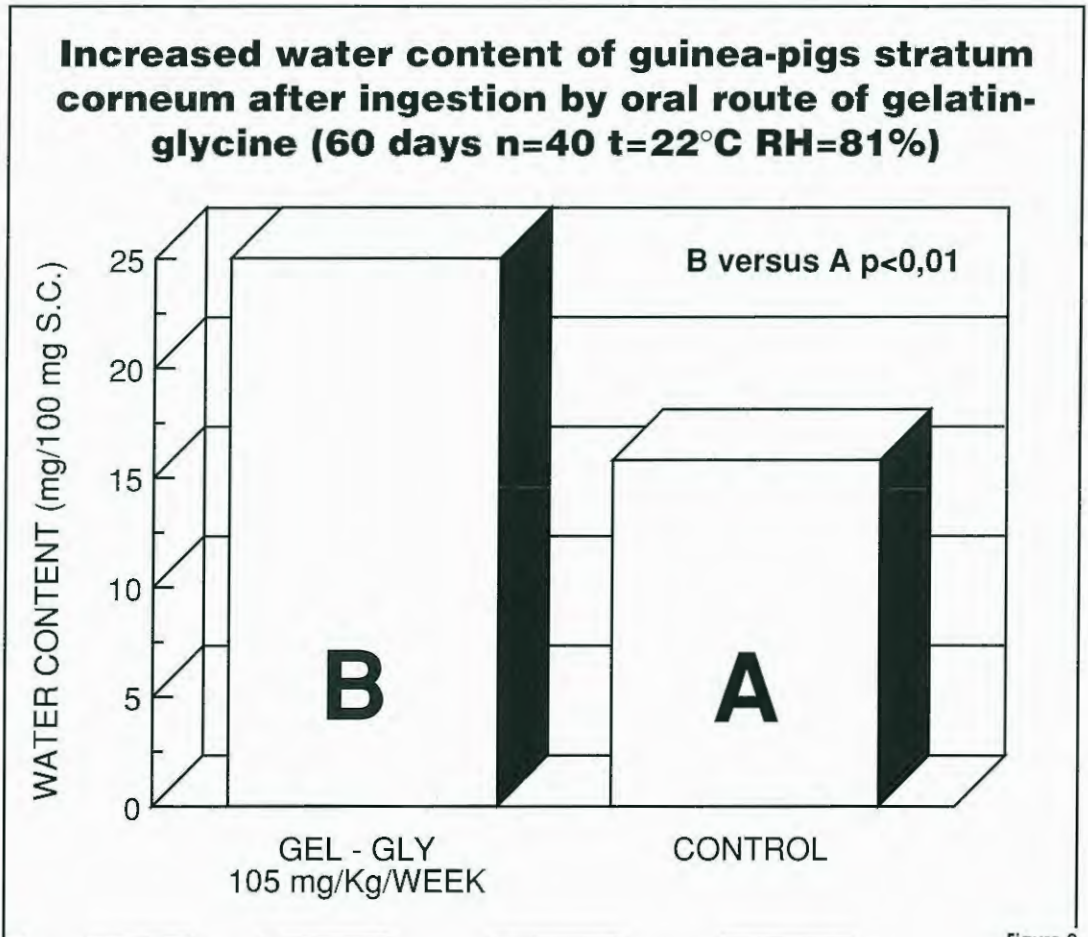


Figure 2

## ***PCA content of stratum corneum in guinea-pigs***

Layers of stratum corneum (0,6x1,5 cm) from the hind of footpads of the two groups of guinea-pigs were extracted in 5,0 ml of 2,0 M HCl solution at 4°C for 3 days, then the extract was filtered through a 0,45  $\mu$  millipore filter.

Pyrrolidone Carboxylic Acid (PCA) contents recorded with an autoanalyzer were determined by analysing samples after heating the extract at 100°C for 2h. The obtained results are shown in Fig. 3.

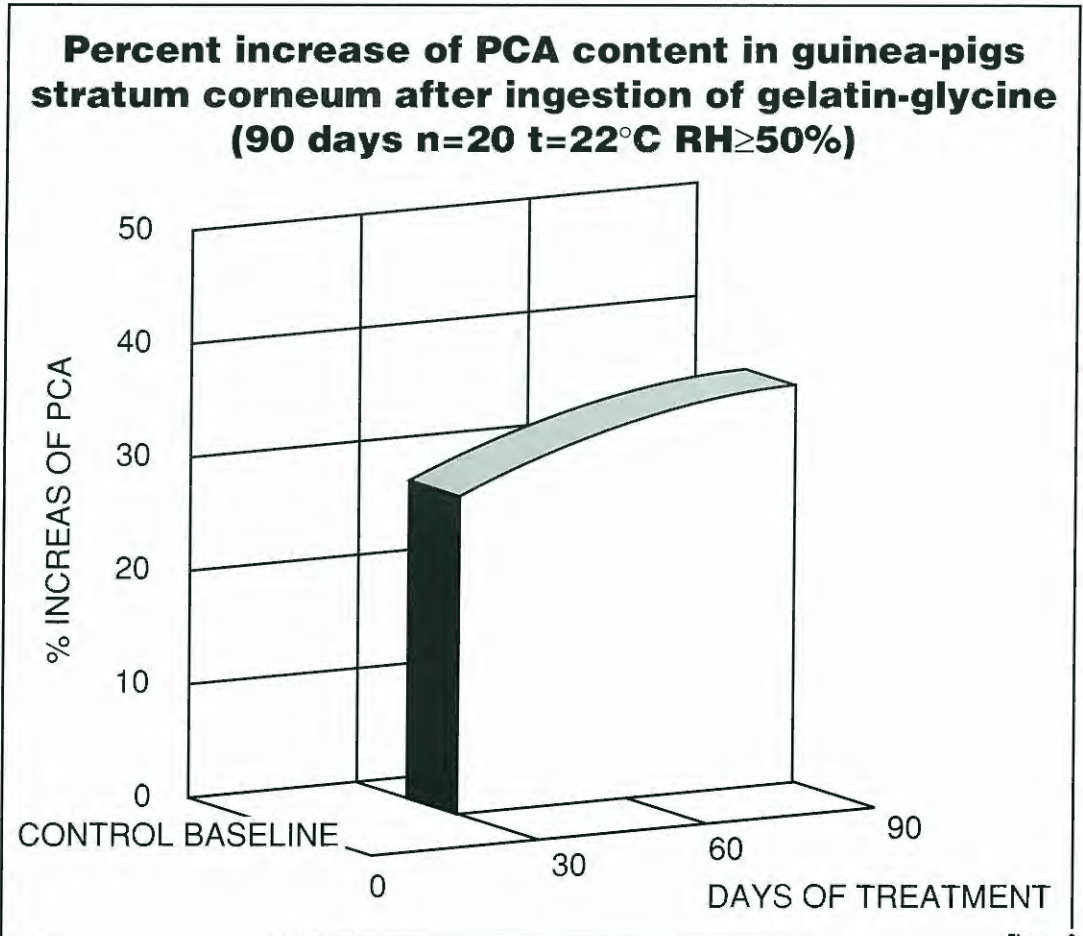


Figure 3

## Evaluation in women

Fifty healthy women volunteers, between 42 and 55 years of age, all with persistent dry skin, were divided into 2 groups of 25 individuals. Each group was randomly given pills sufficient for three months of treatment (4 pills a day). The two groups were:

A- Gelatin and starch (control)

B- Gelatin-Glycine. The pills were administered orally (4 a day) for 120 consecutive days from January to April 1990.

In the 10 days before the treatment all subjects used no cosmetics except a cleansing lotion. Four weeks before, and continually during all the treatment period, drugs, diet foods and cosmetics were prohibited.

## Evaluation of cutaneous hydration on human skin

The mean values for skin hydration were taken from each subject by carrying out four separate measurements in adjacent areas on the forehead. Measurements were taken three times per week (Monday, Wednesday and Friday) up to total of 48 measurements for each subject tested (120 days) between 8:30 and 10:30 a.m. under standardized conditions (RH $\geq$ 50% t=22°C).

A computer-supported system called "3C" has been used to measure skin hydration. This Dermotest computerized system (3C system), based on the principle of constant dielectric measurements, records skin hydration values in direct readout (8). Results are shown in Fig. 4.

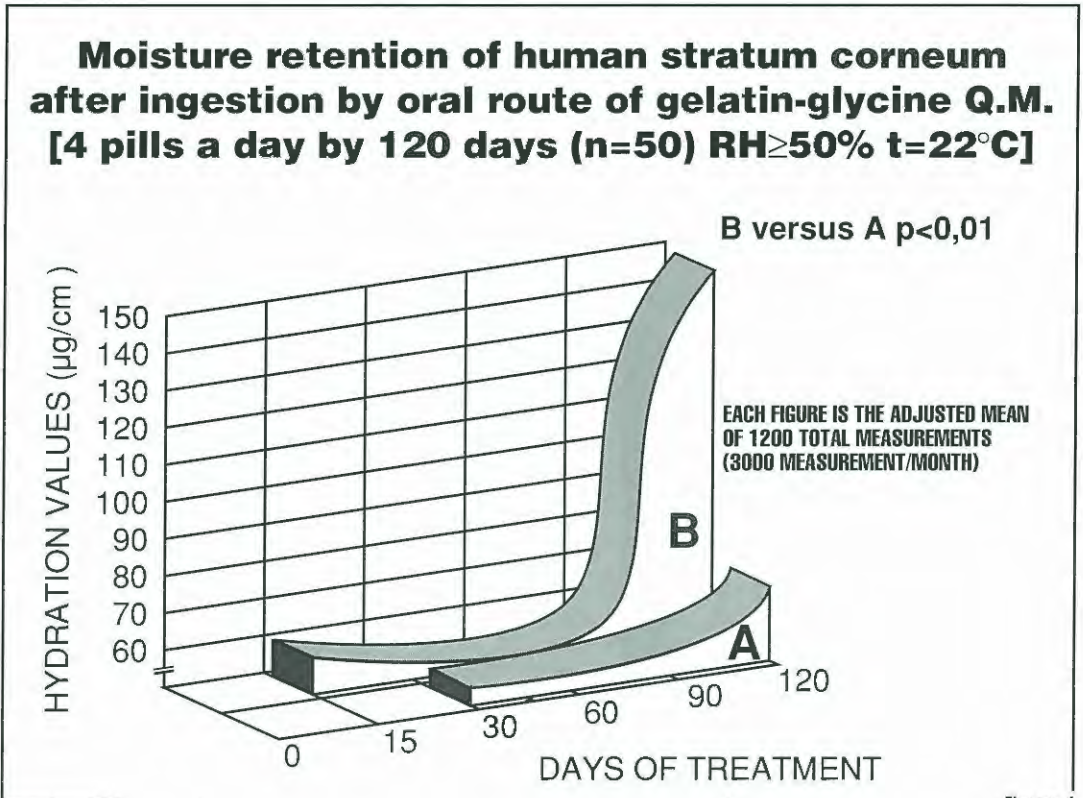


Figure 4

## Extensibility of human SC

Isolated samples of human stratum corneum were obtained from the upper back of 20 subjects ranging in age from 42 to 55 years. These were 10 controls (from group A) and 10 treated (group B).

It was employed a modified version of the cantharidin blister procedure used by Kligman (7). Cantharidin was impregnated into 1 cm diameter disk of filter paper and placed under occlusive patches. The disk were removed after 4 hours and the SC extensibility was measured on the Instron Tester as described previously. The mean results are presented in Fig. 5.

### Increased extensibility of human stratum corneum after treatment by oral gelatin-glycine [4 pills a day by 60 days (n=20) t=22°C RH=81%]

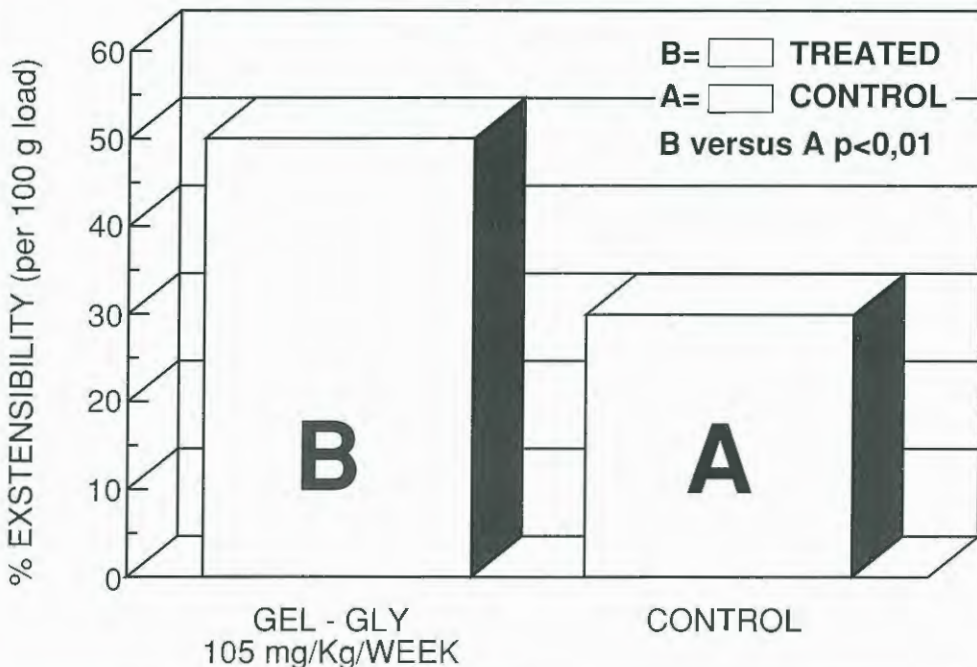


Figure 5

## Conclusion

The results presented here confirm our previous investigation. The oral administration of Gelatin-Glycine seems to exert an interesting moisturizing action, influencing the extensibility, (Tab 1,5), the water content (Tab 2,4) and the level of PCA of SC (3) both in guinea-pigs and in human skin.

The increased hydration related to a precise dosing of gelatin-glycine seems referable to an increased local production of PCA (Tab 3), probably connected also to a stimulation of new collagen and muco polysaccharides production. Moreover the better elasticity exhibited by SC (Tab 1 and 5) is presumably due to a manifestation of the interaction of these macromolecules with the larger amount of absorbed water recorded (tab 2 and 4).

On the basis of this study, treatment by oral gelatin-glycine would seem to be usefull complement to cosmetic use for dry and aged skin.

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## References

1. Blank I.H. (1952) Factors which influence the water content of the stratum corneum - *J. Invest. Derm.* **18**, 433
2. Laden K. (1967) Identification of a natural moisturizing agent in skin - *J. Soc. Cosmet. Chem.* **80**, 437
3. Middleton J. (1968) The mechanism of water binding in stratum corneum - *Br. J. Derm.* **80**, 437
4. Middleton J. (1969) The effect of temperature on extensibility of isolated corneum and its relation to skin chapping - *Br. J. Derm.* **81**, 717
5. Morganti P, Randazzo S.D. (1987) Enriched gelatin as skin hydration enhances - *J. Appl. Cosmetol.* **5**, 105
6. Morganti P, James B. (1989) Gelatin-glycine: improved cutaneous water retention capacity - *J. Appl. Cosmetol.* **7**, 103
7. Kligman A. and Christophers E. (1964) Preparation of isolated sheets of human stratum corneum - *Arch Derm.* **88**, 702