

# The moisturize influence of the commercial cosmetics on the foot skin

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**Abstract:** The work deals with available hydration cosmetics on the human feet, specifically on the findings of the declared hydration effects of selected cosmetics - foot creams. Two groups of creams were selected for testing: creams containing glycerol and creams with the addition of urea, whose hydration effects were detected using the method based on the measurement of electrical capacity. Skin hydration measurements were performed on a group of selected volunteers in different application conditions.

**Key-Words:** - Moisture, Creams, Hydration, Measurement, Urea, Glycerol, Feet

## 1 Introduction

The human skin secures many functions: protection from harmful influences, thermal regulation, respiration and others [1]. One of the layers of skin is epidermis and it is necessary to keep this layer clean and hydrated because dry skin is more prone to skin infections, both bacterial and fungal [2, 3]. Usage of the moisturising creams can help the skin in several ways: preventing damage caused by dryness, providing protection and improving skin appearance [4 - 7]. The best cosmetics are creams that contain emollients, which refine epidermis, humectants designed to soften the skin, and occlusive substances, which stop transpiration [8 - 10]. Hydration of the skin is simple but to achieve and to keep the optimal hydration is difficult [8, 11]. Many recent studies have been focused just on usage of ointment base with humectants as hydration agents [8, 9]. However, commercial by available products (moisturising creams) contain other hydration substances. Therefore, this study is designed to evaluate the hydration effect of commonly applied combinations of humectants, using the corneometric measurement for the detection of hydration changes [10 - 12, 14].

## 2 Methods

For the evaluation of the moisturising effects the apparatus Skin Diagnostic SD 27 was chosen. Skin hydration was measured in the corneometry units, which is based on changes of dielectric constant depending on the amount of water contained in the *stratum corneum*. The values of hydration were expressed in corneometric units (c. u.), related to values of skin irritation 0.5% sodium lauryl solution (SLS). The results shown in the figures are the average values of the measurements in the group of volunteers. Corneometry method is fast, simple and non-invasive. Skin conditions were evaluated according to the following criteria: 0 - 30 c. u. – very dry skin, 31 - 60 c. u. tendency to dryness, 61 - 99 c. u. normal skin. The target group was women from 20 to 41 years of age. Measurements were performed with ethical requirements for this type of biomedical tests [13]. The laboratory temperature was  $24 \pm 2^\circ \text{C}$  and humidity  $61 \pm 2\%$ .

Thirteen cosmetics moisturising products were tested (8 with glycerol and 5 with urea). Table 1 and 2 show composition of cosmetics creams according to International Nomenclature of Cosmetic Ingredients (INCI). The cosmetics are intended for everyday use for dry and hardened

feet skin, hydration and restoration of the barrier function of the skin. Tested moisturising cosmetics were divided into two groups and

each of these groups was tested in 3 application modes: A, B and C.

Table 1 Composition of cosmetics creams with glycerol (according to INCI).

Name	Composition
Balea Fuss, Hirschtalg Creme	Aqua, Caprylic/Capric Triglyceride, Adeps Cervidae, Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate, Cera Flava, Glycerin, Magnesium Sulfate, Chamomilla Recutita Extract, Alcohol, Phenoxyethanol, Dehydroacetic Acid, Benzoic Acid, Aloe Barbadosensis, Rosmarinus Officinalis Oil, Bisabolol, Parfum, Limonene, Linalool
Freeman – barefoot	Aqua, Carthamus Tinctorius Seed Oil, Stearic Acid, Glycerin, Glyceryl Stearate, Melissa Officinalis Extract, Melaleuca Alternifolia Leaf Oil, Butyrospermum Parkii, Theobroma Cacao Seed Butter, Camellia Oleifera Leaf Extract, Tocopheryl Acetate, Panthenol, Dimethicone, Carbomer, Glycol Stearate, Cetyl Alcohol, Sodium Hydroxide, DMDM Hydantoin, Disodium EDTA, Propylene Glycol, Butylene Glycol, Methylparaben, Ethylparaben, Propylparaben, Benzyl Benzoate, Cinnamyl Alcohol, Citronellol, Coumarin, Eugenol, Geraniol, Hexyl Cinnamal, Limonene, Mentha Piperita Oil, Mentha Viridis Leaf Oil, Myristica Fragrans Kernel Oil, Salva Sclareia, Fragrance, Yellow 6 (CI 15985), Red 40 (CI 16035), Blue 1 (CI 42090)
Hirschtalg Creme	Aqua, Petrolatum, Cera Alba, Sorbitan Sesquioleate, Adeps Cervidae, Isopropyl Palmitate, Paraffinum Liquidum, Glycerin, Dimethicone, Cetyl Alcohol, PEG – 7 Hydrogenated Castor Oil, Magnesium Sulfate, Parfum, Rosmarinus Officinalis, Aloe Barvadensis Gel, Propylene Glycol, Bisbolol, Limonane, Linalool, Matricaria ( Chamomilla Recutita), Extract, Benzyl Alcohol, Geraniol, Hexyl Cinnamal, Coumarin, Benzyl Benzoate, Cinnamyl Alcohol, Citronellol, Alpha – Isomethyl Ionone, Hydroxycitronellal, Eugenol, Methylchloroisothiazolinone, Sodium Benzoate, Potassium Sorbate, Methylisothiazolinone
Garnier – regenerative care	Aqua, Glycerin, PEG-2 Stearate, Cetearyl Alcohol, Elaeis Guineensis Oil / Palm Oil, Oleth-12, Stearyl Alcohol, Dimethicone, PEG-40 Glyceryl Cocoate, Allantoin, Sodioum Coceth Sulfate, Sodium Hydroxide, Acer Saccharinum Extract / Sugar Maple Extract, Sorbic Acid, Phenoxyethanol, Parfum / Fragrance (F.I.L B35110/1)
Neutrogena - Norwegian formula-nourishing foot cream	Aqua, Glycerin, Cetearyl Alcohol, Paraffinum Liquidum, Cyclopentasiloxane, Dimethicone, Cera Microcrystallina, Panthenol, Bisabolol, Allantoin, Tocopheryl Linoleate, Dilauryl Thiodipropionate, Paraffin, Palmitic Acid, Stearic Acid, Sodium Cetearyl Sulfate, Sodium Sulfate, Menthol, Methylparaben, Propylparaben, Parfum
Vichy Laboratoires Podexine	Aqua, Glycerin, Cyclohexasiloxane, Isopropyl Myristate, Polyethylene, PEG-2 Stearate, Cetearyl Alcohol, Triethanolamine, Salicylic Acid, Acrylamide/Sodium Acryloyldimethyltaurate Copolymer, PEG-100 Stearate, Stearyl Alcohol, Glyceryl Stearate, Isohexadecane, Methylparaben, Phenoxyethanol, Disodium EDTA, Oleth-12, Polysorbate 80, Parfum / Fragrance, CODE F.I.L. B10642/1
Dermacol sweet feet cream	Aqua, C12-15 Alkyl Benzoate, Glyceryl Stearate, Cetyl Alkohol, Butyrospermum Parkii Butter, Cetearyl Isononanoate, Octyldodecanol, Paraffinum Liquidum, Cetearth-25, Dimethicone, Simmondsia Chinensis Oil, Glycine Soja Oil, Calendula oficinalis Extract, Tocopherol, Sodium Polyacrylate, Trideceth-6, Propylene Glycol, BHT, Ascorbyl Palmitate, Citrid Acid, Disodium EDTA, Triethanolamine, Diazolinidyl Urea, Sodium Benzoate, Potassium Sorbate, 1,2-Hexanediol, 1,2-Octanediol, Tropolone, Linalool, Limonene, Geraniol, Citronellol, Parfum.
Peogel	Aqua, Alcohol Denat., Glycerin, Parfum / Menthol, PEG-40 Hydrogenated Castor Oil, Acrylates / C <sub>10-30</sub> , Alkyl Acrylate Crosspolymer, Triethanolamine, Melaleuca Alternifolia Oil, Allantoin, Linalool, Limonene, Triclosan, Disodium EDTA, Diazolinidyl Urea

Table 2 Composition of cosmetics creams with urea (according to INCI).

Name	Composition
Balea, Urea Fusscreme, mit 10 % Urea	Aqua, Urea, Caprylic/Capric Triglyceride, Cetearyl Alcohol, Alcohol denat., Niacinamide, Phenoxyethanol, Polyacrylic Acid, Cetearyl Glucoside, Glyceryl Caprylate, Lactic Acid, Acrylates/C10-30 Alkylacrylate Crosspolymer, Sodium Hydroxide, Parfum, Coumarin
Burgit footcare	Aqua, Caprylic/Capric Triglyceride, Glycerin, Cetearyl Alcohol, Dimethicone, Simmondsia Chinese Oil, Urea, Hydrogenated Vegetable Oil, Cetearyl Glucoside, Panthenol, Tocopheryl Acetate, Phenoxyethanol, Propylene Glycol, Parfum, Benzoic Acid, Acrylates/C10-30 Alkyl Acrylate Crosspolymer, Xanthan Gum, Bisabolol, Sorbic Acid, Hydrogenated Palm Glycerides Citrate, Tocopherol, Benzyl Salicylate, Limonene, Citronellol, Linalool, Coumarin, Citral, Citric Acid
Scholl, Foot&Nail Cream	Aqua, Glycerin, Paraffinum Liquidum, Urea, Cyclopentasiloxane, Polyglyceryl-3 Methylglucose Distearate, Glyceryl Stearate, Myristyl Alcohol, Panthenol, Dimethicone, Paraffin, Phenoxyethanol, Bisabolol, Tocopheryl Acetate, Allantoin, Methylparaben, Butylparaben, Ethylparaben, Propylparaben, Isobutylparaben, Parfum.
Ozalin	Aqua, Stearic Acid (and) Palmitic Acid, Glycine Soja, Glycerin, Urea, Lanoline, Petrolatum, Dimethicone, Glyceryl Stearate SE, Lecithin, Laureth-30, Lactid Acid, Lavandula, Cetyl Alcohol (and) Stearyl Alcohol, Salicyl Acid, Sodium Hydroxide, Methylparaben (and) Ethylparaben (and) Propylparaben (and) Butylparaben (and) Phenoxyethanol, Disodium EDTA, BHT.
Norwegische formel-Fußcreme	Aqua, Urea, Paraffinum Liquidum, Glycerin, Glyceryl Stearate SE, Cera Microcristallina, PEG-8, Vitis Vinifera, Paraffin, Glycine, Dimethicone, Stearic Acid, Palmitic Acid, Carbomer, Lecithin, Ascorbyl Palmitate, Tocopherol, Sodium Hydroxide, Phenoxyethanol, Methylparaben, Propylparaben

## 2.1 Mode A

Moisturising effects were measured during 4-hour application on the volar forearms of 26 persons. The samples were tested by single application on irritated skin. First was prepared 0.5% solution SLS and used to degrease the skin. Then, filtration papers were placed to the bowl with the solution for 20 seconds and placed on the volunteer's volar forearms. Three of the papers were placed on the left forearm and four of them were located on the right forearm, as illustrated in Fig. 1. Irritation papers were fixed with plasters. Moisturising cosmetics were put into syringes, and they were placed into a desiccator to prevent drying. The irritation papers were taken down after 4 hours and the places were marked and measured by Skin Diagnostic SD 27 instrument. Samples of creams were applied on the marked places. The first place served as a control; it was not irritated, natural skin hydration was measured on the second place. On two places on the left forearm and four places to the right forearm were applied samples of cosmetics from the syringes in the volume of 0.1 ml as shown in

Fig. 2. Corneometric measurement was carried out each hour in the time 4 hours interval. The Creams were tested in two groups: A1 – creams with glycerol and A2 – creams with urea.



Fig. 1 Distribution of the irritation material.



Fig. 2 Tested areas with applied cream samples.

## 2.2 Mode B

The measurement of hydration effect was the same as in mode A, the only difference was in the time of measuring. The hydration effect was measured to the first three hours after application and then nine and ten-hour exposure.

## 2.3 Mode C

In mode C the feet of the volunteers were the places of application. The effects of five moisturising cosmetics were measured every Friday during one month. Volunteers were asked to not mechanically treat their feet and anoint the feet every day after bath

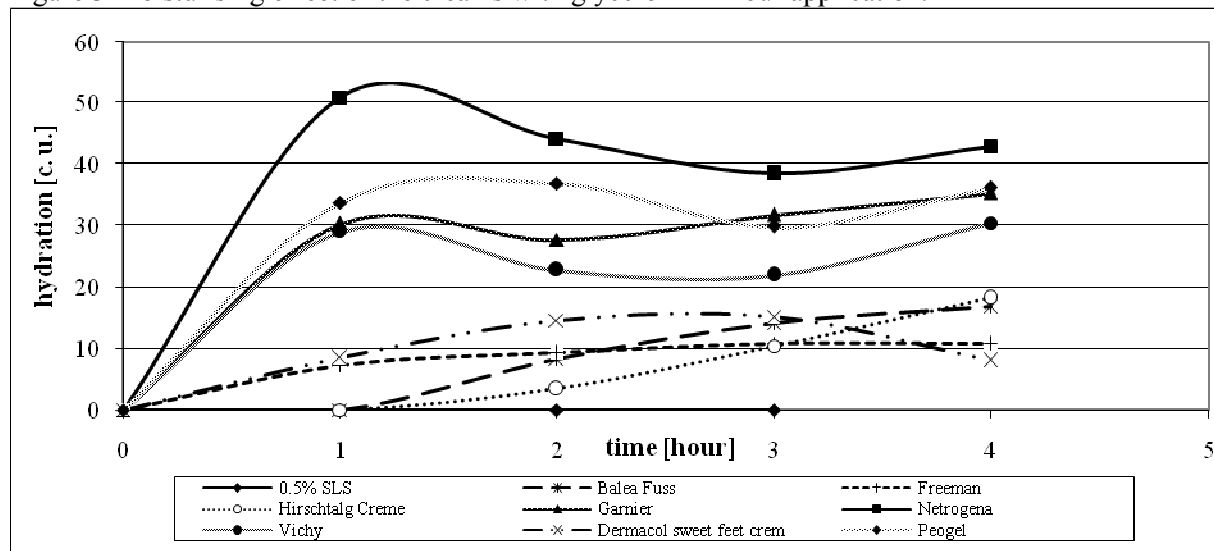
## 3 Results and Discussion

The results below are given in the corneometric units relative to the values of irritated skin.

## 3.1 Mode A1 - Hydration creams with glycerol

Figure 3 shows the hydration effect of the cream with glycerol in 4 hour application. As can be seen, the abilities to hydrate skin of individual samples are different. Neutrogena has the best moisturising effect, it has the highest performance during the first hour after application. On the other hand, Hirschtalg Creme has the worse moisturising effect; hydration impact is five times lower than that of cream Neutrogena. Creams Vichy, Garnier and Peogel have similar moisturising effects. Vichy has twice as high moisturising effect as cream Baleas Fuss. These results can be caused by poor absorption of some creams into the skin (Balea and Hirschtalg). Cream Garnier has high contents of humectants and emollients, which most likely causes its high moisturising effect.

Figure 3 Moisturising effect of the creams with glycerol in 4-hour application.

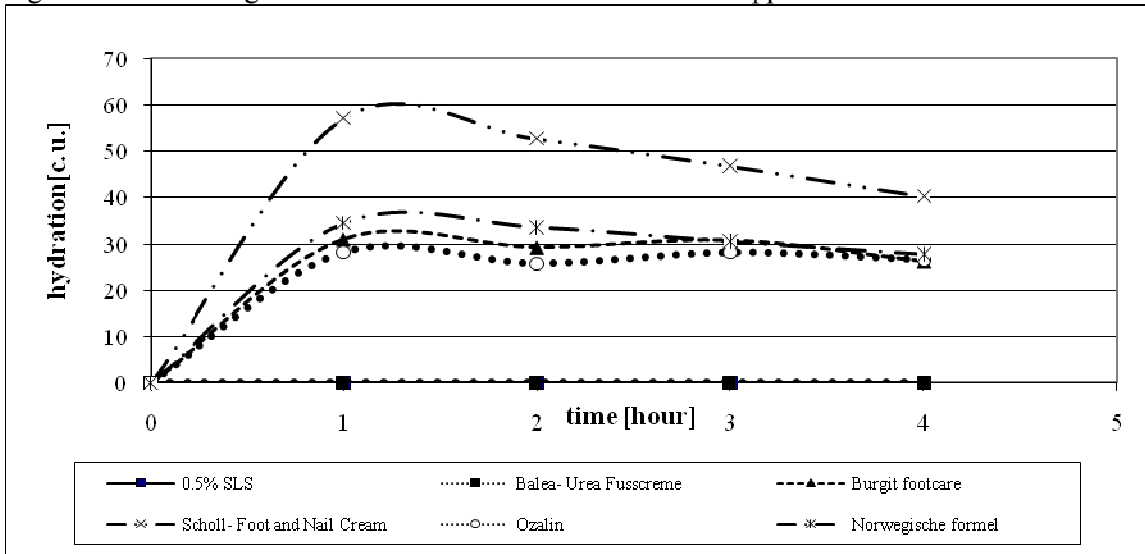


## 3.2 Mode A2 - Hydration creams with urea

Figure 4 shows the hydration effect of creams with urea in 4 hour application. As shown in the table, the highest impact was determined by cream Scholl, where the maximum hydration

appears in the first hour after application on the irritated skin. The worst results, on the other hand, were measured for cream Balea - Urea Fusscreme. Creams Norwegische formel, Burgit footcare and Ozalin have a similar effect during the whole testing time.

Figure 4 Moisturising effect of the creams with urea in 4-hour application.

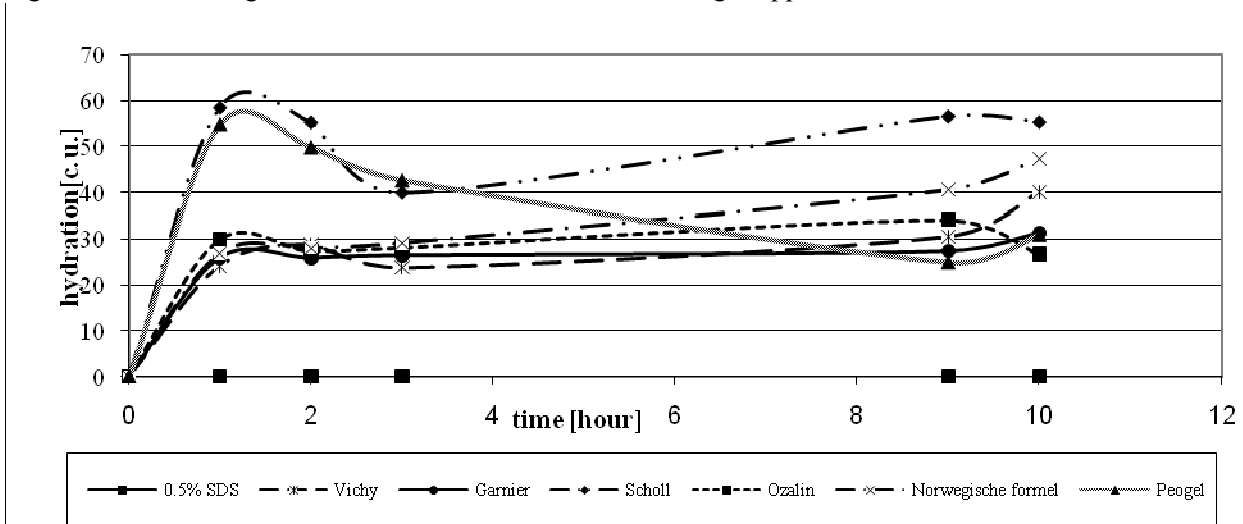


### 3.3 Mode B

Six selected creams were tested overnight: Garnier, Vichy, Scholl, Ozalin, Norwegische formel and Peogel. Figure 5 shows the results of these creams. As can be seen, the highest moisturising effect was measured for cream

Scholl. Peogel has the second highest result, but its effect decreases after the first hour. Vichy as well as other hydration creams shows a constant moisturising effect on the skin during the whole measurement. These creams contain humectants and emollients, which have a great influence on the moisturising factors.

Figure 5 Moisturising effect of the selected creams in overnight application.



### 3.4 Mode C

The measured values were lower on the feet than on the forearms. These differences are caused by the properties of skin. The hydration of feet is more complex because skin on the feet is harder and thicker than skin on the forearms. That is why moisturising effects are so low. The benefits of these creams qualitative change the look of the feet (Fig. 6, 7). These changes are

caused by emollients contained in the creams. Skin becomes softer and without noticeable grooves after monthly application. Figure 6 and 7 were taken with the device Visioscope.



Fig. 6 Appearance before the application of the foot cream.

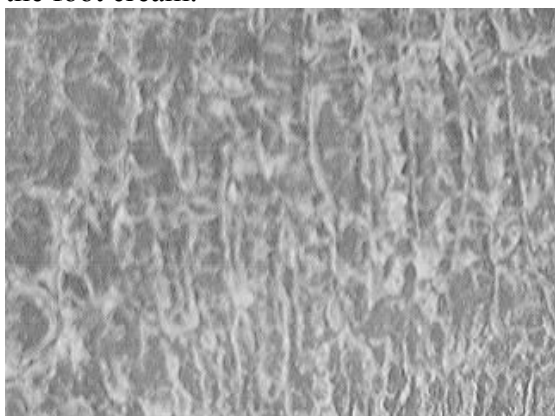


Fig. 7 Appearance after month application of the foot cream.

#### 4 Conclusion

The aim of this work was to verify the declared hydration effect of commercial cosmetics. Creams with urea and glycerol were tested in various modes (4-hour application, application overnight and a month application). The best moisturising effect was found for cream Scholl; its hydration effect was the highest in all three modes. The worst effect, on the other hand, was detected for cream Balea - Urea Fusscreme. The research implies that the price of the creams does not guarantee a high moisturising effect. We want to continue this research and focus on transepidermal water lost (TEWL) after application of these creams on the skin.

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