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Literature List
Skin-Thermometer

A. Soto-Moreno, T. Montero-Vilchez, P. Diaz-Calvillo, A. Molina-Leyva, S. Arias-Santiago, **The impact of photodynamic therapy on skin homeostasis in patients with actinic keratosis: A prospective observational study**, Skin, Research & Technology, Volume 29, Issue 12, December 2023

Background: Photodynamic therapy (PDT) is an effective treatment for actinic keratosis (AKs), but there is little information on how PDT affects skin barrier function. The objectives of this study are: To compare skin barrier function between skin with AKs and healthy skin and to evaluate the impact of PDT on skin homeostasis in patients with AKs. Methods: A prospective observational study was conducted in patients with AKs to evaluate epidermal barrier function and skin homeostasis before and 1 ek after receiving PDT. Results: A total of 21 subjects were included in the study, male/female ratio was 17:4, mean age was 75.86 years. The number of AKS observed before starting treatment was reduced with respect to those diagnosed 1 month after starting PDT (14.83 vs. 1.91, $p < 0.0001$). Application of PDT for treating AKs modifies epidermal barrier function. Immediately after the first session temperature, transepidermal water loss (TEWL), stratum corneum hydration (SCH) and total antioxidant capacity (TAC) increased while pH decreased on lesional skin. After 1-month follow-up, the only remained change was the increased in SCH. Higher increases in temperature were observed when using occlusive PDT compared to mixed modality. 5-ALA and M-ALA seem to have a similar impact on skin barrier. Conclusions: PDT can improve skin barrier function in patients with AKs. Skin homeostasis parameters can be used to assess efficacy and optimize dosing.

M. Herrero-Fernandez, T. Montero-Vilchez, P. Diaz-Calvillo, M. Romera-Vilchez, A. Buendia-Eisman, S. Arias-Santiago, **Impact of Water Exposure and Temperature Changes on Skin Barrier Function**, J. Clin. Med. 2022, 11, 298

The frequency of hand hygiene has increased due to the COVID-19 pandemic, but there is little evidence regarding the impact of water exposure and temperature on skin. The aim of this study is to evaluate the effect of water exposure and temperature on skin barrier function in healthy individuals. A prospective observational study was conducted. Temperature, pH, transepidermal water loss (TEWL), erythema and stratum corneum hydration (SCH) were measured objectively before and after hot- and cold-water exposure and TempTest® (Microcaya TempTest, Bilbao, Spain) contact. Fifty healthy volunteers were enrolled. Hot-water exposure increased TEWL (25.75 vs. 58.58 g·h-1·m-2), pH (6.33 vs. 6.65) and erythema (249.45 vs. 286.34 AU). Cold-water immersion increased TEWL (25.75 vs. 34.96 g·h-1·m-2) and pH (6.33 vs. 6.62). TEWL (7.99 vs. 9.98 g·h-1·m-2) and erythema (209.07 vs. 227.79 AU) increased after being in contact with the hot region (44 °C) of the TempTest. No significant differences were found after contact with the cold region (4 °C) of the TempTest. In conclusion, long and continuous water exposure damages skin barrier function, with hot water being even more harmful. It would be advisable to use cold or lukewarm water for handwashing and avoid hot water. Knowing the proper temperature for hand washing might be animportant measure to prevent flares in patients with previous inflammatory skin diseases on their hands.

D. Sobkowska, J. Gornowicz-Porowska, A. Seraszek-Jaros, D. Słomińska, Z. Adamski, M. Pawlaczyk, **Evaluation of Skin Biophysical Parameters and Angiogenesis Using CD34 as a Biomarker in Older Diabetic Women Treated with Radiofrequency**, Clin Cosmet Investig Dermatol, 2022 Jul 14:15: p. 1347-1355

Background: The prevalence of type 2 diabetes mellitus (t2DM) has been steadily increasing. Patients with t2DM need to slow down the skin ageing processes and to obtain a rejuvenating effect. Treatments that do not damage the superficial layers of the epidermis could be a promising solution for those patients. Purpose: The aim of this study was to evaluate the effects of radiofrequency therapy on the biophysical parameters and angiogenesis of facial skin, using CD34 as a biomarker in older diabetic women treated with metformin. Patients and methods: A total of 45 subjects with phototype 2 or 3 (Fitzpatrick scale) were investigated (25 t2DM - study group, 20 - healthy controls). A series of 6 treatments (once a week) with a Radio Frequency Skin Rejuvenation System device was used on facial

skin. Measurements of skin hydration, transepidermal water loss (TEWL), melanin and erythema index, temperature, and pH, at baseline and after radiofrequency therapy were performed with the Courage + Khazaka MPA-9 device. Immunohistochemistry on paraffin-embedded sections was used to evaluate the intensity of CD34 expression. Results: Radiofrequency treatment significantly improved facial skin hydration ($p < 0.0001$). Enhancement of the epidermal barrier observed, by reduced TEWL as a result of a series of treatments with radiofrequency on the facial skin ($p < 0.0001$), was observed. CD34 was more abundantly expressed after radiofrequency treatment. No side effects were observed. Conclusion: Treatment with radiofrequency is an effective and non-invasive method of facial skin rejuvenation in older women with t2DM, with a relatively short post-procedure recovery time and low potential for severe adverse effects.

T. Montero-Vilchez, A. Martinez-Lopez, A. Sierra-Sanchez, M. Soler-Gongora, E. Jimenez-Mejias, A. Molina-Leyva, A. Buendia-Eisman, S. Arias-Santiago, **Erythema Increase Predicts Psoriasis Improvement after Phototherapy**, J. Clin. Med. 2021, 10, 3897

Psoriasis is a major global health problem. There is a need to develop techniques to help physicians select the most appropriate cost-effective therapy for each patient. The main objectives of this study are (1) to evaluate changes in epidermal barrier function and skin homeostasis after phototherapy and (2) to explore potentially predictive values in epidermal barrier function and skin homeostasis to assess clinical improvement after fifteen sessions of phototherapy. A total of 76 subjects, 38 patients with plaque-type psoriasis and 38 gender- and age-matched healthy volunteers, were included in the study. Erythema, transepidermal water loss (TEWL), temperature, stratum corneum hydration (SCH), pH, sebum, and antioxidant capacity were measured before and after the first and fifteenth phototherapy session. Erythema (401.09 vs. 291.12 vs. 284.52 AU, $p < 0.001$) and TEWL (18.23 vs. 11.44 vs. 11.41 g·m-2·h-1, $p < 0.001$) were significantly higher at psoriatic plaques than in uninvolved psoriatic skin and healthy volunteers, respectively, while SCH was lower (9.71 vs. 44.64 vs. 40.00 AU, $p < 0.001$). After fifteen phototherapy sessions, TEWL (–5.19 g·m-2·h-1, $p = 0.016$) decreased while SCH (+7.01 AU, $p = 0.013$) and erythema (+30.82 AU, $p = 0.083$) increased at psoriatic plaques. An erythema increase exceeding 53.23 AU after the first phototherapy session, with a sensitivity of 71.4% and specificity of 84.2%, indicates that a patient may improve Psoriasis Area and Severity Index (PASI) by ≥3 points after fifteen phototherapy sessions. In conclusion, phototherapy improves epidermal barrier function in psoriatic patients and the erythemaincrease after one phototherapy session could help doctors select psoriasis patients who are more likely to respond to phototherapy.

Ł. Rydzik, T. Ambrozy, Z. Obmiński, W. Błach, I. Ouergui, **Evaluation of the Body Composition and Selected Physiological Variables of the Skin Surface Depending on Technical and Tactical Skills of Kickboxing Athletes in K1 Style**, Int. J. Environ. Res. Public Health 2021, 18, 11625

Background: Kickboxing is a combat sport with high demands on fitness and coordination skills. Scientific research shows that kickboxing fights induce substantial physiological stress. Therefore, it is important to determine the body composition of athletes before competitions and to analyze the skin temperature and skin pH during the fight. Methods: This study aimed to determine the body composition, skin temperature, and skin pH in kickboxers during a fight according to K1 rules. A total of 24 kickboxers (age range: 19 to 28 years) competing in a local K1 kickboxing league participated in the present study. Results: Changes in skin temperature and pH were observed and significant correlations were found between body composition and weight category. Conclusions: Changes in skin temperature and pH were demonstrated after each round of the bout. Level of body fat and muscle tissue significantly correlates with technical-tactical skills of the K1 athletes studied.

I. Micek, J. Nawrot, A. Seraszek-Jaros, D. Jenerowicz, G. Schroeder, T. Spizewsk, A. Suchan, M. Pawlaczyk, J. Gornowicz-Porowska, **Taxifolin as a Promising Ingredient of Cosmetics for Adult Skin**, Antioxidants 2021, 10, 1625

Active substances, effective in the reduction in or delay of skin changes caused by aging occurring in natural compounds, are desirable. Taxifolin (TXF), a flavonoid of strong antioxidant activity found in the plant Stizolophus balsamita (S. balsamita), has been tested for its biological effects on adult human skin. The aim of the study was to investigate the effects of two creams: 3% S. balsamita extract and 3% TXF on the function of adult skin. In total, 97 Caucasian women with clinical signs of skin aging were investigated. The biophysical and biomechanical skin parameters were measured before and after applying the creams, using Colorimeter CL400, Mexameter MX16, Skin-pH-Meter PH900, Skin-Thermometer ST 500, Glossymeter GL200, and Cutiscan SC100. Patch tests were performed with the investigated products to assess their potential irritant properties. The percutaneous penetration of creams was examined with the use of electrospray ionization mass spectrometry (ESI-MS) and confocal Raman spectroscopy. The 3% S. balsamita extract cream reduced hyperpigmentation, erythema, and

elevated pH. All the tested preparations were proven to be nonirritant. A higher penetration rate was revealed for the 3% TXF cream than for the 3% S. balsamita extract cream. A total of 3% TXF cream improved skin viscoelasticity. The obtained results suggested that S. balsamita extract and TXF may be considered as ingredients of skincare products for adults.

T. Yazdanparast, K. Yazdani, S.A. Nasrollahi, L. Izadi Firouzabadi, P. Humbert, A. Khatami, A. Firooz, **Biophysical and ultrasonographic changes in pityriasis rosea compared with uninvolved skin**, International Journal of Women's Dermatology 7 (2021) 331–334

Background: Pityriasis rosea (PR) is a common, self-limited, inflammatory papulosquamous skin disease with a possible viral etiology. Objective: The goal of this study was to evaluate skin biophysical properties in patients with PR compared with uninvolved skin to better understand the pathogenesis of PR. Methods: Stratum corneum hydration, transepidermal water loss, surface friction, pH, sebum, melanin, erythema, temperature, elasticity parameters (R0, R2, R5), thickness, and echodensity of the epidermis and dermis were measured on lesions of classic PR in 21 patients and compared with control sites (average of uninvolved perilesional and symmetrical skin) with a paired t test. Results: Stratum corneum hydration ($p < .001$), R0 ($p = .003$), R2 ($p = .001$), R5 ($p = .003$), and echodensity of the dermis ($p = .006$) were significantly lower, whereas transepidermal water loss ($p = .001$), pH ($p < .001$), and erythema ($p < .001$) were significantly higher in PR lesions. There was no significant difference in friction index, sebum, melanin content, temperature, thickness of the epidermis and dermis, and echodensity of the epidermis between PR and normal skin. Conclusion: PR skin is characterized by certain alterations in biophysical properties, which are mostly correlated with histologic changes. These changes may be helpful in early, noninvasive diagnosis of PR.

D. Maroto-Morales, T. Montero-Vilchez, S. Arias-Santiago, **Study of Skin Barrier Function in Psoriasis: The Impact of Emollients**, Life 2021, 11, 651

Psoriasis is a chronic multi-systemic inflammatory disease that affects the epidermal barrier. Emollients can be used as a coadjutant therapy for psoriasis management, but little is known about how the epidermal barrier function in psoriatic patients is modified by moisturizers. The objective of this study is to evaluate the effect of Vaseline jelly and a water-based formula on epidermal barrier function in psoriatic patients. Thirty-one patients with plaque-type psoriasis and thirty-one gender and age-matched healthy controls were enrolled in the study. Temperature, transepidermal water loss (TEWL), stratum corneum hydration (SCH), pH, elasticity and the erythema index were measured using non-invasive tools before and after applying Vaseline jelly and a water-based formula. TEWL was higher in psoriatic plaques than uninvolved psoriatic skin (13.23 vs. 8.54 g·m-2·h-1; $p < 0.001$). SCH was lower in psoriatic plaques than uninvolved psoriatic skin and healthy skin (13.44 vs. 30.55 vs. 30.90 arbitrary units (AU), $p < 0.001$). In psoriatic plaques, TEWL decreased by 5.59 g·m-2·h-1 ($p = 0.001$) after applying Vaseline Jelly, while it increased by 3.60 g·m-2·h-1 ($p = 0.006$) after applying the water-based formula. SCH increased by 9.44 AU after applying the water-based formula ($p = 0.003$). The use of emollients may improve epidermal barrier function in psoriatic patients. TEWL is decreased by using Vaseline, and SCH is increased by using the water-based formula.

A. Cekiera, J. Popiel, M. Siemieniuch, Z. Jaworski, M. Slowikowska, N. Siwinska, A. Zak, A. Niedzwiedz, **The examination of biophysical parameters of the skin in Polish Konik horses**, PLoS ONE 16(6), June 2021

This study aimed to assess the biophysical parameters of the skin in Polish Konik horses (Polish primitive horses). According to the authors, this is the first assessment performed on such a wide scale in this group of animals. The evaluation carried out is innovative both with regards to the breed of the animals and the wide scope of the physicochemical skin assessment. The study group comprised mares, stallions and geldings, and the evaluations concerned transepidermal water loss, corneometry, pH, skin temperature assessment and mexametry. These parameters were assessed in five skin regions: the lips, the right ear, the prosternum, the right side of the neck and the chest. The measurements were taken after spreading the hair apart, with the use of a Multiprobe Adapter System (MPA®) and dedicated probes (Courage + Khazaka electronic GmbH, Cologne, Germany). The measurements revealed statistically significant differences in the values of transepidermal water loss in the lips in mares compared with stallions ($P = 0.023$) and also in stallions compared with geldings ($P = 0.009$). Corneometry showed significantly higher results in the neck region in mares compared with stallions ($P = 0.037$) and the prosternum areas in mares and geldings compared with stallions ($P = 0.037$ and $P = 0.018$). Skin pH measurement on the right side of the neck rendered significantly higher values in stallions than in mares ($P = 0.037$). In geldings, the skin temperature was significantly higher than in stallions ($P = 0.049$). Once the appropriate physicochemical values for specific animal species and breeds are determined, non-invasive methods of skin examination in many diseases and also methods

of evaluation of the efficacy and/or adverse effects of applied medications can be established.

L. Weiß, **Charakterisierung hautphysiologischer, lokal inflammatorischer und penetrationsdynamischer Parameter nach milder Hautbarriereschädigung - Praktische Bedeutung für transkutane Vakzinierungsstrategien**, Dissertation an der Medizinischen Fakultät Charité – Universitätsmedizin Berlin, Germany, June 2021 (in German)

Introduction: Transcutaneous vaccination strategies have been in the focus of research for several years. Amongst these, needle-free vaccination methods avoid many challenges associated with conventional vaccination. Concomitantly, overall efficacy for various different approaches has been shown by other authors with delivery via the cutaneous route favoring the induction of cellular immune responses. Furthermore, an increase in penetration and immune activation have been discovered to be significant aspects in transcutaneous vaccination. Whether physical, chemical or biochemical stimuli are able to procure this is has not been thoroughly investigated. Methods: Based on clinical studies using skin surface treatment in transcutaneous vaccination this project analysed the effects of physical and chemical skin barrier disruption in combination with topical vaccine application. Firstly, skin-physiological parameters were analysed to determine the degree of barrier disturbance by the disruption methods. Secondly, the inflammatory milieu of the epidermis was investigated with ELISA and Array analyses and a more detailed investigation using RT-qPCR was conducted for Cyanoacrylat Skin Surface Stripping (CSSS). Finally, the influence of skin barrier disruption on the penetration of topically applied vaccine was analysed using histological staining and ELISA. Results: For physical disruption no persistent impairment of the skin physiology was found. The evaluation of different inflammation markers however showed signs of IL-1alpha stimulation after tape stripping, and array analyses indicated increased immune response to CSSS compared to tape stripping. RT-qPCR uncovered an increased gene-expression of various pro-inflammatory molecules after CSSS and CSSS combined with topical vaccine application. In regard to the chemical disruption methods, occlusion of water and imiquimod indicated a mild effect on skin physiology, while more severe disruption was seen after 2 % SLS occlusion. Occlusion with water and imiquimod also showed a stimulating effect on the excretion of IL- 1alpha. Penetration was increased following occlusion of SLS. 9 Discussion: Tape stripping and CSSS seemed to result in improved penetration of topically applied vaccine despite only causing mild and temporary skin barrier impairment. Furthermore, CSSS has shown itself to be an efficient immune-stimulus, causing a diverse immune response in combination with topical application of vaccine.

J. Kottner, U. Blume-Peytavi, **Reliability and agreement of instrumental skin barrier measurements in clinical pressure ulcer prevention research**, Int Wound J. 2021; p. 1-12

In skin and wound research the instrumental measurement of skin function is established. Despite the widespread use, empirical evidence about measurement errors is widely lacking. The aim of this study was to measure reliability and agreement of skin temperature, transepidermal water loss, epidermal hydration, and erythema at the heel and sacral skin. Four experienced researchers performed skin measurements in 15 subjects. Lowest reliability was observed for transepidermal water loss at the sacral skin (ICC (1) 0.46 (95% CI 0.00-0.78)) and highest for skin temperature at the heel skin (ICC (1) 0.99 (95% CI 0.99-1.00)). Lowest Standard Errors of Measurement were calculated for skin temperature measurements at the heels (0.11°C) and highest for erythema measurements at the sacral skin (26.7 arbitrary units). There was a clear association between variability of estimates and reliability coefficients. Single measurements of skin temperature, stratum corneum, and epidermal hydration at the sacral and heel skin areas can be used in clinical research and practice. Means of at least two measurements should be used for estimating transepidermal water loss and erythema. Evidence is needed to inform researchers about relative and absolute measurement errors of commonly applied instruments and measurements in skin and wound research.

T. Wongsanaoa, W. Leemingsawata, V. Panapisalb, T. Kritpet, **Thermoregulatory effects of guava leaf extract-menthol toner application for post-exercise use**, Pharmaceutical Biology 2021, Vol. 59, No. 1, p. 852–857

Context: Psidium guajava L. (Myrtaceae) leaf contains a wide variety of bioactive compounds that contribute valuable effects on human well-being. Objective: This study investigates the influence of guava leaf extract-menthol toner on thermoregulation, including perspiration, skin temperature, and recovery heart rate.Materials and methods: This randomised, placebo-controlled clinical trial assessed the effects of the guava leaf extract-menthol toner and placebo with a 1-week washout period. Sixty-four participants were enrolled. The participants exercised on a treadmill until a 75% heart rate reserve was achieved for 5 min,followed by a 5 min post-exercise rest period. The skin temperature and heart rate were then measured before 5 mL of the testing product was sprayed to specific areas of the body, left it for 30 sec before wiped off. Post-exercise perspiration and skin temperatures were collected by sweat patches and measured by the Skin-thermometer ST500, respectively. A 20 min heart rate

monitoring period started 10 min after the exercise and measured every 2 min intervals. Results: Use of the toner significantly reduced post-exercise perspiration to approximately half of the baseline and placebo use values ($p < 0.05$). Furthermore, relative heart rate changes showed no significant differences among the tests ($p > 0.05$). Skin temperature was also unaffected ($p > 0.05$). Discussion and Conclusion: Guava leaf extract-menthol toner reduced perspiration by astringent effects but did not influence heat dissipation and did not affect cardiovascular mechanism compared to the controls. Additional cleaning with guava leaf extract-menthol toner could offer better hygiene after a workout.

T. Yazdanparast, K. Yazdani, S.A. Nasrollahi, L. Izadi Firouzabadi, P. Humbert, A. Khatami, M. Kassir, A. Firooz, **Biophysical and ultrasonographic changes in early patch/plaque stage of mycosis fungoides, compared with uninvolved skin,** Skin Research & Technology, Volume 26, Issue 6, November 2020, p. 859-866

Background: The goal of this study was evaluation of the skin biophysical properties in early patch/plaque stage of mycosis fungoides (MF) and its comparison with uninvolved skin in order to gain a better understanding of the pathogenesis of diseases. Materials and Methods: The stratum corneum hydration, transepidermal water loss (TEWL), surface friction, pH, sebum, melanin, erythema, temperature, elasticity parameters (R0, R2, R5), thickness, and echo density of epidermis and dermis were measured on lesions of 21 patients and compared with controls (average measures of uninvolved perilesional and symmetrical skins) by paired sample *t* test. Results: Stratum corneum hydration ($P < 0.001$) and echo density of dermis ($P = 0.044$) were significantly lower, whereas pH (P-value = 0.007), erythema ($P < 0.001$), and melanin content ($P = 0.007$) were significantly higher in lesions. There was not any significant difference in TEWL, friction index, sebum, temperature, R0, R2, R5, thickness of epidermis and dermis, and echo density of epidermis between lesions and normal skin. Conclusion: Parapsoriasis/MF lesions are specified by a set of certain changes in biophysical properties which are mainly correlated with histological changes. These sets of alterations may help in noninvasive, early diagnosis of parapsoriasis/MF.

F. Elban, E. Hahnel, U. Blume-Peytavi, J. Kottner, **Reliability and agreement of skin barrier measurements in a geriatric care setting**, Journal of Tissue Viability online, July 2020

Background: The non-invasive skin barrier measurements transepidermal water loss, stratum corneum hydration and the skin surface pH are widely used in clinical skin research. Relative and absolute measurement errors of these measurements are unknown in geriatric care settings. Material and methods: Transepidermal water loss, stratum corneum hydration, skin surface pH and temperature were measured on the volar forearm and lower leg twice by trained raters within a cross-sectional study in ten nursing homes. Intrarater reliability was calculated using the ICC (1,1). Intrarater agreement was analyzed using Bland Altman Plots with limits of agreement. Results: Two hundred twenty-three residents were included and mean age was 84.2 years. The highest ICC was found for transepidermal water loss and skin surface temperature of the leg with 0.95 (95% CI 0.93 to 0.96). The ICC of the stratum corneum was 0.91 (95% CI 0.88 to 0.93) for both investigated skin areas. The measurement of the pH at the lower leg had the lowest ICC with 0.73 (95% CI 0.66 to 0.78). Highest limits of agreement of approximately 8 a.u. were calculated for stratum corneum hydration and lowest limits of agreement of approximately 1 ◦C were calculated for skin surface pH. Conclusion: Relative measurement errors of transepidermal water loss and stratum corneum hydration were very low indicating that single measurements provide reliable estimates in this population and setting. However, the absolute measurement errors were high for both of these parameters. To increase reliability of skin surface pH we recommend at least two repeated measurements.

S.E. Eskandari, A. Firooz, M. Nassiri-Kashani, M.R. Jaafari, A. Javadi, A. Miramin Mohammadi, A. Khamesipour, **Safety Evaluation of Topical Application of Nano-Liposomal Form of Amphotericin B (SinaAmpholeish) on Healthy Volunteers: Phase I Clinical Trial**, Iran J Parasitol: Vol. 14, No. 2, Apr-Jun 2019, p.197-203

Background: We aimed to evaluate the safety of SinaAmpholeish in a doubleblind, randomized, phase 1 clinical trial in healthy human volunteers. Methods: The study was carried out in DermaLab of Center for Research and Training in Skin Diseases and Leprosy, Tehran University of Medical Sciences, Tehran, Iran in 2012. A topical Nano-liposomal formulation of 0.4% Amphotericin B was developed against Leishmania under trade name of SinaAmpholeish. In this randomized, double-blind, right-left, comparative, phase I clinical trial, in 2 steps; 7 and 20 healthy volunteers were recruited and applied SinaAmpholeish on the right and its vehicle on the left volar side of forearm, twice a day for one week or 3 times a day for two weeks. Seven biophysical skin parameters were measured in standard conditions before and 2 wk after application. Results: There was no adverse effect when SinaAmpholeish and its vehicle were used twice a day for seven days. However, when were used 3 times a day for two weeks, both SinaAmpholeish and its vehicle induced severe local skin reactions in

2 volunteers leading to discontinuation of application. Mild and temporary local reactions were observed in about half of the application sides and there was no significant difference between SinaAmpholeish and its vehicle. Conclusion: The new formulation is safe and worth to be tested in further phase 2 clinical trial and since there was no adverse effect with twice a day application it was decided to use SinaAmpholeish twice a day in phase 2 clinical trial.

T. Yazdanparast, K. Yazdani, P. Humbert, A. Khatami, S.A. Nasrollahi, H. Zartab, L. Izadi Firouzabadi, A. Firooz, **Biophysical and ultrasonographic changes in lichen planus compared with uninvolved skin**, International Journal of Women's Dermatology 5 (2019), p. 100–104

Background: Lichen planus (LP) is a chronic inflammatory disease of the skin. Currently, noninvasive techniques are used to evaluate biophysical properties of the skin in vivo. Objective: In this study, we aimed to evaluate skin biophysical properties in patients with LP and make a comparison between involved and uninvolved skin to provide a better understanding of the pathogenesis of LP. Methods: The stratum corneum hydration, transepidermal water loss, pH, erythema, melanin, sebum, friction, temperature, elasticity parameters (R0, R2, R5), and thickness and echo-density of the epidermis, dermis, and subepidermal low echogenic band were measured on lesions of classic LP in 21 patients and compared with the average of perilesional and symmetrical uninvolved skin (as control) with a paired t test. Results: Stratum corneum hydration (p = .002), sebum (p = .04), R0 (p = .005), and echo-density of the dermis (p = .005) were significantly lower, but pH (p = .007), melanin content (p b .001), erythema (p b .001), temperature (p = .01), thickness of dermis (p = .02), and subepidermal low echogenic band (p b .001) were significantly higher in LP lesions. Conclusion: An evaluation of its biophysical, biomechanical, and ultrasonographic characteristics showed that the skin is an objective, noninvasive, and quantitative measuring tool that can be used to provide valuable information about skin changes in classic LP.

*J. Suñer-Carbó, A. Calpena-Campmany, L. Halbaut-Bellowa, B. Clares-Naveros, M.J. Rodriguez-Lagunas, E. Barbolini, J. Zamarbide-Losada, A. Boix-Montañés***, Biopharmaceutical Development of a Bifonazole Multiple Emulsion for Enhanced Epidermal Delivery**, Pharmaceutics 2019, 11, 66

Efficient topical delivery of imidazolic antifungals faces the challenge of overcoming its limited water solubility and its required long-lasting duration of treatments. In this paper, a hydrophilic multiple emulsion (ME) of Bifonazole (BFZ) is shown to maximize its skin retention, minimize its skin permeation, and maintain an acceptable level of being harmless in vivo. The formulations were pharmaceutically characterized and application properties were assessed based on viscosity measurements. Non-Newtonian pseudoplastic shear thinning with apparent thixotropy was observed, facilitating the formulation retention over the skin. The in vitro release profile with vertical diffusion cells showed a predominant square-root release kinetic suggesting an infinite dose depletion from the formulation. Ex vivo human skin permeation and penetration was additionally evaluated. Respective skin permeation was lower than values obtained with a commercial O/W formulation. The combination of amphoteric and non-ionic surfactants increased the bifonazole epidermal accumulation by a factor of twenty. This fact makes the possibility of increasing its current 24 h administration frequency more likely. Eventual alterations of skin integrity caused by the formulations were examined with epidermal histological analysis and in vivo preclinical measurements of skin elasticity and water retrograde permeation. Histological analysis demonstrated that the multiple emulsions were harmless. Additionally, modifications of in vivo skin integrity descriptors were considered as negligible.

T. Yazdanparast, K. Yazdani, P. Humbert, A. Khatami, S.A. Nasrollah, H. Hassanzadeh, A.H. Ehsani, L. Izadi Firouzabadi, A. Firooz, **Comparison of biophysical, biomechanical and ultra-sonographic properties of skin in chronic dermatitis, psoriasis and lichen planus**, Med J Islam Repub Iran. 2018(5 Nov);32.108

Background: Skin biometrology is a useful method for evaluation of inflammatory skin disorders such as dermatitis, psoriasis, and lichen planus. The current study tries to compare the biophysical features of skin in dermatitis, psoriasis, and lichen planus. Methods: By a convenient sampling method, 22 mild to moderate chronic dermatitis, 26 psoriasis, and 21 lichen planus patients were recruited in the study. Stratum corneum (S.C.) hydration, Transepidermal water loss (TEWL), pH, erythema, melanin, sebum, friction, elasticity parameters (R0, R2, and R5), skin temperature, skin thickness, and echo-density of epidermis and dermis were measured on the lesional (selected active lesion), uninvolved perilesional, and uninvolved symmetrical skin. The average of perilesional and symmetrical uninvolved parameters was used as control, while the percentage change of each parameter [(lesion – control / control) ×100] was calculated, and compared among three diseases by ANOVA test using SPSS software version 18. The significance level was set at α=0.05. Results: Comparison of percentage changes showed that the changes in TEWL, friction index, sebum content, R2 (gross elasticity), R5 (net elasticity), skin temperature, dermal thickness, and epidermal density are not significantly different

among three skin diseases. But there were significant differences in three diseases considering the decrease in S.C. hydration ($p<0.001$), R0 (opposed to firmness) ($p<0.001$), and dermal density ($p<0.001$) compared to control skin. Moreover, the increase in skin pH ($p<0.001$), melanin content ($p=0.048$), erythema ($p=0.023$), and epidermal thickness ($p <0.001$) significantly differed among these diseases. Conclusion: Dermatitis, psoriasis and lichen planus lesions had specific biophysical changes. It may be helpful in their differential diagnosis.

I.I. Shuvo, K. Chakma, D. Toutant, **Prospect of 3D Warp Knitted Spacer Fabric and its Effect on Pressure Relieve for Reducing the Prevalence of Pressure Ulcers for Immobile Patients**, Journal of Textile Science & Engineering, Volume 8, Issue 1, 2018

Many hospitals use paper thin bed sheets with high friction coeffcients which are not ideal for patients with pressure ulcers and who are at risk of developing. These patients suffer a great deal of pain, which could have been prevented. Lying on a weak bed sheet with no regards to regulating micro-climate is a clear promoter of pressure ulcers. Another key factor of a hospital bed sheet is they are to be easily washed or disposed of because of all the unknown fluids that could seep onto the sheet. Therefore, the sheet must not only be to comfort those with pressure ulcers but to be easily washable and reusable. Again, in a hospital setting being able to easily wash the sheet and for it to hold its form is signifcant for reducing the cost of throwing away sheets less often. Therefore a theory has been proposed to design a 3D knit spacer bed sheet that will allow patients with pressure ulcers to be comfortable by ensuring a low friction coeffcient between their skin and the material. The friction coeffcient will be reduced by not only the structure but by the 70 percent polyester, 22 percent polypropylene and eight percent spandex blend. The friction coeffcient will stay low due to a high wicking and evaporation capability to ensure the skin stays dry as well as the material. The 3D knit spacer bed sheet also has a higher compressibility which distributes pressure more evenly as well as enabling a care giver to easily rotate an immobile person into a new position. The proposed bed sheet will be easily washable to ensure all bodily fluids such as vomit, blood, and others have been removed. This blanket will be slightly more expensive but is expected to last longer than a typical hospital bed sheet.

T. Tomova-Simitchieva, A. Lichterfeld-Kottner, U. Blume-Peytavi, J. Kottner, **Comparing the effects of 3 different pressure ulcer prevention support surfaces on the structure and function of heel and sacral skin: An exploratory cross-over trial,** International Wound Journal, 2017; p. 1–9

Special support surfaces are key in pressure ulcer prevention. The aim of this study was to measure the effects of 3 different types of mattresses (reactive gel, active alternating air, basic foam) on skin properties of the sacral and heel skin after 2 hours loading. Fifteen healthy females (median age 66 years) were included. Transepidermal water loss, skin surface temperature, erythema, stratum corneum hydration, epidermal hydration, skin extensibility, elastic function, and recovery as well as skin roughness parameters were measured under controlled room conditions before loading, immediately after loading, and 20 minutes postloading in the supine position on the different mattresses. The highest increases in transepidermal water loss, skin temperature, and erythema were observed for the foam mattress after loading, indicating higher deformation and occlusion. Cutaneous stiffness decreased in all 3 groups, indicating structural changes during loading. There was a substantial decrease of mean roughness at the heel skin in the foam group, leading to a flattening of the skin surface. Study results indicate that the type of support surface influences skin structure and function during loading. The gel and air mattress appeared to be more protective compared with the foam mattress, but the differences between the gel and air were minor.

E. Hahnel, U. Blume-Peytavi, C. Trojahn, J. Kottner, **Associations between skin barrier characteristics, skin conditions and health of aged nursing home residents: a multicenter prevalence and correlational study,** BMC Geriatrics (2017) 17:263

Background: Geriatric patients are affected by a range of skin conditions and dermatological diseases, functional limitations and chronic diseases. Skin problems are highly prevalent in elderly populations. Aim of this study was to investigate possible associations between health, functional and cutaneous variables in aged long-term care residents. Methods: This observational, cross-sectional, descriptive prevalence study was conducted in a random sample of 10 institutional long-term care facilities in Berlin. In total, n = 223 residents were included. Demographic and functional characteristics, xerosis cutis, incontinence associated dermatitis, pressure ulcers and skin tears were assessed. Stratum corneum hydration, transepidermal water loss, skin surface pH and skin temperature were measured. Data analysis was descriptive and explorative. To explore possible bivariate associations, a correlation matrix was created. The correlation matrix was also used to detect possible collinearity in the subsequent regression analyses. Results: Mean age (n = 223) was 83.6 years, 67.7% were female. Most residents were affected by xerosis cutis (99.1%; 95% CI: 97.7% - 100.0%). The prevalence of pressure ulcers was 9.0% (95% CI: 5.0% - 13.0%), of incontinence associated dermatitis 35.4% (95%

CI: 29.9% - 42.2%) and of skin tears 6.3% (95% CI: 3.2% - 9.5%). Biophysical skin parameters were not associated with overall care dependency, but with age and skin dryness. In general, skin dryness and measured skin barrier parameters were associated between arms and legs indicating similar overall skin characteristics of the residents. Conclusion: Prevalence of xerosis cutis, pressure ulcers and skin tears were high, indicating the load of these adverse skin conditions in this population. Only few associations of demographic characteristics, skin barrier impairments and the occurrence of dry skin, pressure ulcers, skin tears and incontinence-associated dermatitis have been detected, that might limit the diagnostic value of skin barrier parameters in this population. Overall, the measured skin barrier parameters seem to have limited diagnostic value for the reported skin conditions except xerosis cutis.

E. Hahnel, U. Blume-Peytavi, C. Trojahn, G. Dobos, A. Stroux, N. Garcia Bartels, I. Jahnke, A. Lichterfeld-Kottner, H. Neels-Herzmann, A. Klasen, J. Kottner, **The effectiveness of standardized skin care regimens on skin dryness in nursing home residents: A randomized controlled parallel-group pragmatic trial,** International Journal of Nursing Studies 70 (2017), p. 1–10

Background: Aged residents of institutional long-term care facilities are at high risk for developing skin and tissue diseases. Besides various common skin problems, dry skin (xerosis cutis) is one of the most frequent skin conditions in this setting. Objectives: To investigate the effectiveness of two structured skin care regimens in comparison to routine skin care on xerosis cutis in nursing home residents. Design: A multi-center, pragmatic, randomized, controlled, investigator blinded study with three parallel groups. Settings: The study was conducted in a random sample of ten out of 291 institutional long-term care facilities of the federal state of Berlin, Germany. Participants: Long-term care residents being 65+ years affected by dry skin were included. Methods: The residents were allocated into one of three study groups. Two interventional groups used standardized skin care regimens, consisting of a body wash and twice daily applications of leave-on products for eight weeks. The third control group performed skin care as usual. All participating residents were examined at baseline and after 4 and 8 weeks. Xerosis cutis was measured with the Overall Dry Skin score. Instrumental skin barrier measurements were performed at baseline and after 8 weeks. Diaries were used to document washing and skin care frequencies. Results: In total, 133 residents were included and allocated to one of the three groups. Mean age was 83.8 (SD 8.3) years, 65.4% were female and most residents had care levels I (42.9%) or II (42.9%) according to the German Social Code Book XI. Mean Barthel score was 46.8 (SD 24.2) and mean Braden score was 17.6 (SD 3.7). Leg skin areas were drier compared to arms and trunk areas. At the end of the study the Overall Dry Skin scores in the intervention groups were lower compared to the control group. There were statistically significant improvements of skin dryness in both intervention groups compared to the control group over time. Conclusions: The results of this pragmatic trial indicate that structured skin care regimens are effective in reducing skin dryness in aged nursing home residents within eight weeks.

J. Kottner, G. Dobos, A. Andruck, C. Trojahn, J. Apelt,H. Wehrmeyer, C. Richter, U. Blume-Peytavi, **Skin response to sustained loading: A clinical explorative study,** Journal of Tissue Viability (2015) 24, 114 – 122

Abstract Background: Severe illness, disability and immobility increase the risk of pressure ulcer development. Pressure ulcers are localized injuries to the skin and/or underlying tissue as a result of long enduring pressure and shear. Little is known about the role of the stratum corneum and the upper skin layers in superficial pressure ulcer development. Objectives: To investigate possible effects of long enduring loading on the skin barrier function under clinical conditions at two pressure ulcer predilection sites. Methods: Under controlled conditions 20 healthy females (mean age 69.9 (3.4) years) followed a standardized immobilization protocol of 90 and 150 min in supine position wearing hospital nightshirts on a standard hospital mattress. Before and immediately after the loading periods skin surface temperature, stratum corneum hydration, transepidermal water loss and erythema were measured at the sacral and heel skin. Results: Prolonged loading caused increases of skin surface temperature and erythema at the sacral and heel skin. Stratum corneum hydration remained stable. Transepidermal water loss increased substantially after loading at the heel but not at the sacral skin. Conclusions: Skin functions change during prolonged loading at the sacral and heel skin in aged individuals. Accumulation of heat and hyperaemia seem to be primarily responsible for increasing skin temperature and erythema which are associated with pressure ulcer development. Increased transepidermal water loss at the heels indicate subclinical damages of the stratum corneum at the heel but not at the sacral skin during loading indicating distinct pathways of pressure ulcer development at both skin areas.

X. Li, C. Galzote, X. Yan, L. Li, X. Wang, **Characterization of Chinese body skin through in vivo instrument assessments, visual evaluations, and questionnaire: influences of body area, inter-generation, season, sex, and skin care habits,** Skin Research and Technology 2014; 20: 14-22

Background/Purpose: The varying influence of mutiple factors (e.g., aging, sex, season, skin care habits) on skin structure and function necessitates study within ethnic groups to fully characterize their skin. Methods: Men and women aged 40-50 years (n=43) and their consanguineous same sex-children, aged 18-25 years (n=43), living in Chengdu, China were enrolled in this single center, non-interventional study. Volunteers attended two study visits (summer, 2010 and winter, 2011) at which dermatologists measured transepidermal water loss (TEWL), skin hydration, sebum secretion, fine lines/roughness, melanin/erythema, termperature, and color, and clinically graded participants' skin.

C. Uhl, D. Khazaka, **Techniques for globally approved skin testing,** Personal Care April 2013

In efficacy testing and claim support for cosmetic products, objective measurement systems became indispensable long ago, especially since subjective clinical assessments are often prone to bias and inter-observer variation. Without suitable instrumentation it is close to impossible to determine what a product is really doing for the skin. Those objective measurement methods and subjective evaluations are mutually dependent. No measurement can be performed without the subjective evaluation of the results by the user of such instrumentation. However, a pure subjective evaluation of the skin without appropriate measurement techniques is not able to achieve accurate results either. This relationship becomes clearer when looking for example at skin colour measurements. Subjectively, the human brain cannot process slight changes in colour, especially when the colours are not viewed side by side, but at different points in time. Instrumental measurement however will clearly detect such slight changes. The achieved result must then be interpreted in context with the expected outcome or the hypothesis. For this, you will always need a knowledgeable and experienced person because 'a fool with a tool is still a fool', as the late Albert Kligman used to say. This relationship between objective measurement and subjective evaluation is not only true for the determination of differences in skin colour, but also for all other skin measurement parameters important for the cosmetic industry.

P. Kleesz, R. Darlenski, J.W. Fluhr, **Full-Body Skin Mapping for Six Biophysical Parameters: Baseline Values at 16 Anatomical Sites in 125 Human Subjects,** Skin Pharmacol Physiol 2012; 25; p. 25-33

The skin, as the outermost organ, protects against exogenous hazards (outside-in barrier) and prevents the loss of essential parts of the body (inside-out barrier) The epidermal barrier exerts several functions with specific morphological elements. Regional differences in skin functions are well known. The aim of the present study was to assess and compare skin physiological parameters in vivo at 16 anatomical sites: Barrier function in terms of transepidermal water loss (TEWL), stratum corneum (SC) hydration (assessed by capacitace), skin surface pH, skin surface temperature, erythema index and skin pigmentation were quantified at 16 anatomical sites under basal conditions.

G.-B. Fan, P.-L. Wu, X.-M. Wang, **Changes of oxygen content in facial skin before and after cigarette smoking**, Skin Research and Technology 2012; 18; 511-515

Cigarette smoking is directly related to several potentially fatal conditions, including cardiovascular disease, chronic obstructive pulmonary disease, bronchial carcinoma, and cancer (1). Several studies had indicated that cigarette smoking affects the facial skin leading to wrinkles and pale-gray color tone of the skin, a condition often referred to as premature skin aging (2-4). Cigarette smoke contains a large number of free radicals and redox-active compounds. There is considerable evidence showing that reactive oxygen species (ROS) are the key contributors to the degradation (5-7). In addition, the change in the oxygen content of the facial skin after smoking may also be related to lipid peroxidation and protein degradation, although this has not been empirically evaluated.

C. Try, R. Messikh, A. Elkhyat, F. Aubin, P. Humbert, **Utilisation de oxybutynine a la posologie de 7,5 mg par jours dans le traitement des hyperhidroses primitives**, Rev Med Liège 2012; 67: 10: p. 520-526, (Article in French*)*

Oxybutynin is being increasingly being prescribed in the treatment of hyperhidrosis but currently, there is no precise dosage for this treatment. Nine patients were treated for primary hyperhidrosis resistant to conventional therapies with oxybutynin between January to May 2010. The treatment was progressively increased at 7.5 mg per day. Oxybutynin efficacy was evaluated by iodine starch test and biometrological measurements at 2 and 4 weeks of treatment. Hyperhidrosis Disease Severity Scale (HDSS) and Dermatology Life Quality Index (DLQI) were obtained for each patient. The means of HDSS and DLQI were respectively 3.2 ± 0.7 and 17.0 ± 5.1 before treatment and were 1.8 ± 0.4 and 4.6 ± 4.4 at 4 weeks of treatment. Oxybutynin at 7.5 mg per day significantly decreased intensity and area of sweat for palms but not for soles. Trans Epidermal Water Loss, conductance, pH and Skin temperature were modified with treatment. Oxybutynin at 7.5 mg per day has improved patient's quality of life. Efficiency of oxybutynin in primary palmar hyperhidrosis was proved by biometrological measurements and iodine starch test.

G. Mayeux. E. Xhauflaire-Uhoda, G.E. Piérard, **Patterns of aluminium hydroxychloride deposition onto the skin,** Skin Research and Technology, 2011

The normal stratum corneum (SC) is nearly impermeable except for some small size xenobiotics and a minute amount of water evaporating from its surface. This property supports the concept of a diffusional barrier function that may be weakened in some conditions. The remarkable barrier effect results from the highly organized structure of the SC. The predominant route for water passage is though to reside in the intercorneocyte path composed of a complex mixture of lipids structured in rigid bilayer arrays. In practice, the measurement of transepidermal water loss (TEWL) is performed at rest in a cool environment in order to assess this physiological process. Under physical or emotional stress, TEWL is severely altered by sweating.

E. Xhauflaire-Uhoda, G. Mayeux, P. Quatresooz, A. Scheen, G.E. Piérard, **Facing up to the imperceptible perspiration. Modulatory influences by diabetic neuropathy, physical exercise and antiperspirant,** Skin Research and Technology 2011; 17: p. 487-493

Eccrine Sweating is under the control of the cholinergic sympathetic innervation. It plays an essential role in regulating body temperature in physiologic and pathologic conditions. This function is altered by some systemic diseases including diabetic neuropathy, which commonly involves the distal sensorimotor innervation. The resulting peripheral sweating deficit is often responsible for unequivocal abnormalities of length-dependent thermoregulatory sweating. Hence, the legs affected by diagetic neuropathy most often present hypohidrosis that has been though to be compensated by hyperhidrosis on the upper body regions. Other sweating changes in diabetes include segmental hypohidrosis and more rarely isolated dermatome involvement.

C. Try, R. Messikh, A. Elkhyat, J.M. Sainthillier, C. Vidal, T. Lihoreau, S. Mac-Mary, A. Jeudy, P. Humbert, **Biometrological Assessment of Sweat Secretion. Clinical Study of Oral Oxybutynin in Primary Hyperhidrosis**, ISBS 2010 Buenos Aires, Argentina

Primary hyperhidrosis may be a disabling condition causing emotional stress and negative impact on a patient's quality of life. Oral anticholinergics are some of the treatments available. There are few published data on the use of the anticholinergic drug oxybutynin given orally in the treatment of hyperhidrosis. To evaluate the efficacy and the safety of oral oxybutynin in the treatment of primary hyperhidrosis. From January to June 2010, patients with primary hyperhidrosis were treated with oral oxybutynin in the Department of Dermatology, Besançon, France, and attended follow-up. Treatment was started with oxybutynin 2.5 mg three times daily during 3 days. The 3 following days, the dose of oxybutynin was increased at 5 mg per day. Patients then took 7.5 mg of oxybutynin per day during 24 days. The study lasted 1 month from the first day of oxybutynin treatment. Patients were evaluated every two weeks by clinical and biometrologic methods. The following parameters were assessed on the palm and plant: degree of sweating was determined by measuring Trans Epidermal Water Loss (TEWL) using a double-probe Tewameter (TM 300; Courage+Khazaka), skin temperature (Thermometer® ST500), skin pH (pH-meter, PH 900) and skin hydration (Corneometer®, CM 825).

A. del Pozo, M. Solans, C. Fernandez, M. Dolz, Corrias, M. Herráez, O. Diez-Sales, **Efficacy evaluation and characterization of chitosan nano emulsions with Spirulina hydro-glycolic extract,** IFSCC Barcelona 2008 Presentation and Poster

Nanoemulsions represent an interesting prospect for use as vehicles in the development of formulations to deliver active ingredients to the human body. Particularly, nanoemulsion formulations have been shown to be superior for transdermal and dermal delivery of hydrophilic and lipophlic compounds, compared to conventional vehicles, such as hydrogels and emulsions. Lecithins (phosphatidylcholines) have been used in several studies as surfactants for topical nanoemulsion vehicles. These surfactants are able to form nanoemulsions without cosurfactants. In this context, less surfactant is associated with lesser irritation.

L. Ambroisine, K. Ezzedine, A. Elfakir, S. Gardinier, J. Latreille, E. Mauger, M. Tenenhaus, C. Guinot, **Relationships between visual and tactile features and biophysical parameters in human facial skin,** Skin Research and Technology 2007; 13: p. 176 – 183

Skin properties, such as colour, hydration and texture, can be studied on a qualitative basis by a clinical assessment or on a quantitative basis using techniques that measure biophysical properties of the skin. The aim of this study was to explore the links between facial skin features and a range of skin biophysical parameters using multivariate methods.