SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 5 | May 2024 - Peer Reviewed Journal

APPLICATION OF TEWL IN FORMULATION OF SOAPS

Shubham Sakharam Shinde[1*], Abrar Altaf Shaikh[2], Shubham Annashaheb Tigote[3]
[1]Student of bachelor's in pharmacy, Dr. Babasaheb Ambedkar Technological University, Raigad, Lonere.
[2]Department of Pharmacology, Faculty of Pharmacology, Dr. Babasaheb Ambedkar Technological University, Raigad, Lonere
[3]Student of bachelor's in pharmacy, Dr. Babasaheb Ambedkar Technological University, Raigad, Lonere

ABSTRACT
Transepidermal water loss (TEWL) is the most widely used objective measurement for assessing the barrier function of skin in healthy individuals but also patients with skin diseases that are associated with skin barrier dysfunction, such as atopic dermatitis. TEWL is the quantity of condensed water that diffuses across a fixed area of stratum corneum to the skin surface per unit time. The water evaporating from the skin is measured using a probe that is placed in contact with the skin surface and contains sensors that detect changes in water vapor density. TEWL can be measured using an open-chamber, unventilated-chamber, or condenser-chamber device. It is a sensitive measure that is affected by properties of the surrounding microclimate such as environmental humidity, temperature, and airflow and should be measured under controlled conditions. TEWL varies significantly across different anatomical sites and also depends on sweat gland activity, skin temperature, and corneocyte properties. Here we describe how to optimally use TEWL measurements as a skin research tool in vivo and in vitro.

KEYWORDS: *Moisturizing Properties, Barrier Function, Sensitive Skin, Humectants, Emollients, Occlusives, pH Balance, Surfactants, Natural Ingredients.*

1.INTRODUCTION

Transepidermal water loss (TEWL) is an objective measurement of skin integrity measured as the amount of water lost across the stratum corneum. TEWL varies greatly across variables such as age and anatomic location, and disruptions in the skin barrier have been linked to inflammatory trematodes such as psoriasis and atopic dermatitis. Impact of environmental conditions and pollution on TEWL has yet to be determined. Accordingly, this review summarizes effects of environmental conditions and pollution on TEWL.[1]

TEWL is an amount of water per unit area of skin and per unit of time exiting the body through the skin into the atmosphere through diffusion and evaporation. The normal value of TEWL in children is 0-15 g/m2/h (gram / square meter / hour).[2]

Transepidermal water loss (TEWL) is the most widely used objective measurement for assessing the barrier function of skin in healthy individuals but also patients with skin diseases that are associated with skin barrier dysfunction, such as atopic dermatitis. TEWL is the quantity of condensed water that diffuses across a fixed area of stratum corneum to the skin surface per unit time. The water evaporating from the skin is measured using a probe that is placed in contact with the skin surface and contains sensors that detect changes in water vapor density. TEWL can be measured using an open-chamber, unventilated-chamber, or condenser-chamber device. It is a sensitive measure that is affected by properties of the surrounding microclimate such as environmental humidity, temperature, and airflow and should be measured under controlled conditions. TEWL varies significantly across different anatomical sites and also depends on sweat gland activity, skin temperature, and corneocyte properties. Here we describe how to optimally use TEWL measurements as a skin research tool in vivo and in vitro.[3]

1.1.WHAT IS TEWL?

The measurement of transepidermal water loss or skin surface vapor loss is a good indicator of the integrity of the skin barrier function which inherently refers to the skin's ability to retain moisture.[4]

1.2.TEWAMETER TM 300 :Assessing the Skin Barrier Function

The measurement of transepidermal waterloss (TEWL) the most important parameter for evaluating the efficiency of the skin water barrier. Even the slightest damage in the skin water bamer can be de- termined at an early stage. The Tewameter" is the most accepted and best selling TEWL measurement device worldwide.[5] Many international scientific studies demonstrate its importance in dermatological and cosmetological fields. There are various fields of application. Besides efficacy testing and claim support for cosmetics and pharmaceuticals, and objective clinical diagnosis in dermatology, there is a large application in occupational medicine, medical consultancy, observation of the newborn, the food industry and many more fields.[6]

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 5 | May 2024 - Peer Reviewed Journal

2.MATERIAL AND METHOD

TEWL and SSWL were measured utilizing an Evaporimeter (Servo Med, Sweden) (8). Thehand-held probe samples atmospheric hydration at two points above skin surface; evaporation is calculated from the detected water gradient. A clip containing a screen and spacing ring was attached to the probe, minimizing sensor contamination from formulations on the skin. Additionally, a 10-mm tall polyethylene chimney was fabricated and added to the probe's open chamber. This, in conjunction with the time constant filter "10 on the instrument, helped dampen air-current induced measurement fluctuations.[7] While the water loss measurement is stable utilizing the chimney and clip attached to the protective Teflon chamber, in vivo TEWL measurements register higher than when the bare hygrosensors are placed at a similar position above the skin; actual TEWL is possibly overestimated with our probe arrangement, but the stability makes small relative changes detectable. Skin temperature was recorded with a skin surface temperature probe (Telethermometer, Yellow Springs, OH, USA). All TEWL were corrected to a common temperature of 30°C (9). Increasing relative humidity decreases TEWL (10, 11). While uncontrolled in this study, relative humidity and room temperature were recorded, respectively, with another Evaporimeter and a mercury thermometer. Relative humidity fell between 40-55% and room temperature 18-24°C. Relative humidity fluctuations were too small to detect a corrrelation considering measurement variability.[8]

2.1. Instrumentation (hydration)

SC water content was directly sampled with the dielectric water content probe. This instrument consists of a coaxial cable attached to a Wavetek 1005 (Indiana) microwave generator and detector.[9]

A signal swept several megahertz about 1 gigahertz resonates in the cable; a charged grid at the cable-end (probe-tip) limits the depth of emitted electric field. When the probe (emitting less than 1 microwatt of (energy) contacts the skin, cutaneous water absorbs energy and produces a standing-wave phase shift, the detection of which is adjusted to be linearly proportional to the hydration level.[10] The instrument output is processed electronically and graphed on a chart recorder or interpreted with a minicomputer. The probe, attached to a flexible arm, contacts the skin through gravity which produces a constant probe pressure. While measuring almost instantaneously, the probe must rest on the skin surface for about 3s. This allows the probe to settle producing a more stable reading (if left on longer, the probe senses increasing hydration due to occlusion). Five measurements are taken per site and averaged. The DPR unit is a percentage based on the skin probe's response against that for a drop of water. While not a true hydration percentage (liquid water and water bound to the SC show different dielectric constants), this basic unit remains useful for relative comparisons.[11]

TEWAMETER

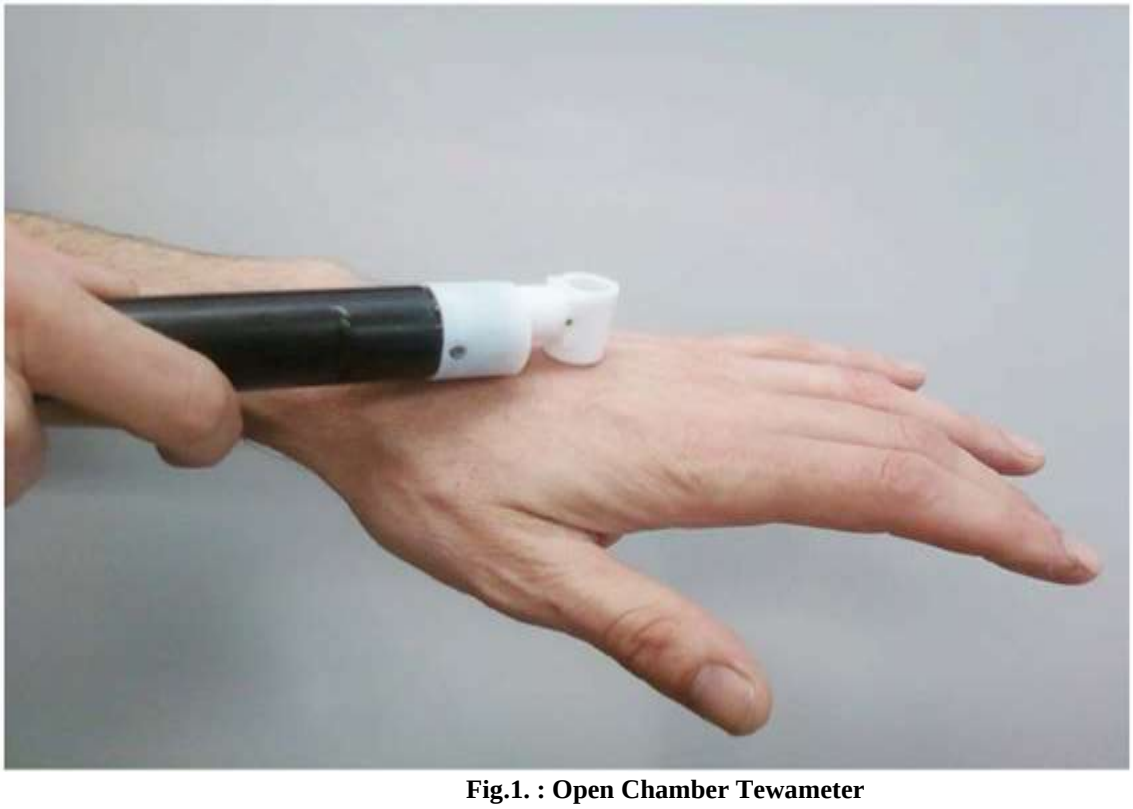

Fig.1. : Open Chamber Tewameter

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 5 | May 2024 - Peer Reviewed Journal

3.ADVANTAGE

- ✓ The open chamber measurement is the only method to assess the TEWL continuously. which is necessary for most applications set hut influencing the ok ernartace. Numerous
- ✓ Plausibility of measurement of one largo area with higher precision and reproducible
- ✓ The valued out be slowed single values or as average The probe hoods can easily be acute with high Taxability. [12]

4.APPLICATION

✓ Trans epidermal water loss (TEWL) is the most widely used objective measurement for assessing the barrier function of skin in healthy individuals.

✓ Skin diseases in which the skin barrier is disturbed, such as atopic dermatitis (AD), contact dermatitis, and psoriasis, are associated with elevated TEWL.

✓TEWL measurements are used as a skin research tool in vivo and in vitro.

even slight deficiencies in the balmoral of the indispensable in efficacy testing and artisan support for and pharmaceuticals

- ✓ Termagant Objective in cat sis of smear improve merit and mechanisms of product behaviour Seest studies cant-per-spirant efficacy test Demonstrative pergie to specialization azad interesting applications in veterinary methodology and sociology. [15]

4.1. Regulatory Affairs of Trans-Epidermal Water Loss (TEWL)

Trans-epidermal water loss (TEWL) is a key parameter used to assess the integrity and functionality of the skin barrier. It is widely used in dermatological research, cosmetic product development, and regulatory evaluations to determine the effectiveness of skin care products and treatments. Regulatory affairs concerning TEWL involve the standardization of measurement methods, ensuring the safety and efficacy of products claiming to influence TEWL, and compliance with relevant regulations and guidelines.[16]

4.2. Standardization of TEWL Measurement

1. ISO Guidelines: The International Organization for Standardization (ISO) provides guidelines for measuring TEWL to ensure consistency and reliability across different studies and product evaluations. ISO 19402:2018 outlines the specific methods and equipment to be used for TEWL measurements.
2. Equipment Calibration and Validation: TEWL measurement devices, such as open-chamber and closed-chamber instruments, must be regularly calibrated and validated to ensure accurate readings. Regulatory bodies may require proof of calibration and validation during product evaluations.[17]

4.3. Regulatory Requirements for Skincare Products

1. Product Claims: Products claiming to affect TEWL, such as moisturizers, barrier creams, and anti-aging treatments, must provide scientific evidence to support their claims. This often involves conducting clinical trials or studies that measure TEWL before and after product use.
2. Safety and Efficacy: Regulatory agencies, such as the U.S. Food and Drug Administration (FDA) and the European Medicines Agency (EMA), require comprehensive safety and efficacy data for products intended to modulate TEWL. This includes toxicity studies, allergenicity tests, and long-term use effects.
3. Labeling and Advertising: Claims related to TEWL must be clear, substantiated, and not misleading. Regulatory bodies scrutinize product labels and advertising materials to ensure compliance with regulations.[18]

4.4. Compliance and Regulatory Oversight

1. Good Manufacturing Practices (GMP): Manufacturers of skincare products must adhere to GMP guidelines to ensure product quality and consistency. This includes maintaining detailed records of TEWL measurements and other testing procedures.
2. Post-Market Surveillance: Regulatory agencies may conduct post-market surveillance to monitor the ongoing safety and efficacy of products that claim to influence TEWL. This can involve collecting data on adverse reactions and conducting periodic reviews of product performance.
3. Third-Party Testing and Certification: Independent testing and certification by third-party organizations can provide additional assurance of a product's ability to affect TEWL. Regulatory bodies may recognize these certifications as part of the product approval process.[19]

5.KEY REGULATORY DOCUMENTS AND STANDARDS

1. ISO 19402:2018: Provides guidelines for TEWL measurement methods and equipment.
2. FDA Guidance for Industry: Offers recommendations for the submission of safety and efficacy data for skincare products.
3. EMA Guidelines on the Evaluation of Medicinal Products for Skin Conditions: Outlines the requirements for clinical trials and product evaluations affecting the skin barrier function.[20]

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 5 | May 2024 - Peer Reviewed Journal

6. DISCUSSION

The findings of this study reveal significant factors influencing TEWL and, consequently, skin barrier function. High humidity environments contribute to lower TEWL, emphasizing the role of external moisture in maintaining skin integrity. This insight is crucial for individuals in dry climates or those exposed to artificial heating or cooling, which can reduce ambient humidity and increase TEWL. The study also highlights the efficacy of skincare products, especially occlusive agents, in reducing TEWL. This supports the use of specific formulations in skincare routines to enhance barrier function and retain skin moisture. The significant reduction in TEWL with moisturizers aligns with previous research, validating the protective role of these products.

7. CONCLUSION

Trans-epidermal water loss (TEWL) is a vital parameter for assessing skin barrier function and hydration status. This study demonstrates the significant impact of various factors on TEWL, including environmental conditions, skincare products, and physiological states.
Environmental Humidity: High humidity environments are associated with lower TEWL, indicating better skin barrier function in moist conditions. This finding emphasizes the importance of maintaining adequate ambient humidity to support skin health, particularly in dry climates or artificial environments.

Skincare Products: The application of moisturizers, especially those containing occlusive agents, significantly reduces TEWL. This suggests that these products enhance skin barrier function and improve hydration. The results support the use of specific formulations in skincare routines to protect and restore the skin barrier.

Age: TEWL tends to increase with age, reflecting the natural decline in skin barrier function over time. This suggests the need for targeted skincare interventions for older populations to support and maintain skin barrier function.

8. IMPLICATIONS FOR DERMATOLOGY AND SKINCARE

Environmental Control: Maintaining appropriate environmental conditions, particularly humidity levels, is essential for supporting skin barrier function. This is particularly relevant for individuals living in dry climates or working in controlled environments with artificial heating or cooling.

Product Development: The efficacy of skincare products in reducing TEWL highlights the importance of ingredient selection in product formulation. Occlusive agents and other barrier-enhancing ingredients should be prioritized in the development of moisturizers and treatments for compromised skin barriers

Hydration: Ensuring adequate hydration, both internally and externally, is crucial for maintaining healthy skin. This includes drinking sufficient water and using hydrating skincare products.[21]

9. FUTURE DIRECTIONS

Further research is needed to explore the long-term effects of various environmental factors, skincare products, and physiological changes on TEWL. Additionally, studies investigating the molecular mechanisms underlying TEWL and barrier function can provide deeper insights into developing more effective skincare treatments.

In summary, TEWL is a critical indicator of skin barrier health. Understanding the factors that influence TEWL can guide dermatological practices and skincare product development, ultimately leading to improved skin health and protection.

10. RESULT

TEWL, or Transepidermal Water Loss, is a measure of the amount of water that passes from inside a body through the epidermal layer to the surrounding atmosphere. This measure is often used to assess the integrity of the skin barrier function. Here's how to interpret the results of a TEWL measurement:

Low TEWL: Indicates a well-functioning skin barrier. This suggests that the skin is effectively retaining moisture and preventing water loss, which is typical of healthy, hydrated skin.

Moderate TEWL: Indicates a moderately functioning skin barrier. The skin is retaining some moisture but is also losing some water. This could be normal for some skin types or conditions.

High TEWL: Indicates a compromised skin barrier. The skin is losing more water than normal, which can be a sign of dryness, irritation, or underlying skin conditions such as eczema, psoriasis, or other dermatological issues.

Very High TEWL: Indicates a severely compromised skin barrier. This can be a sign of significant skin damage or severe dermatological conditions. Immediate attention to skin hydration and barrier repair is usually necessary.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 5 | May 2024 - Peer Reviewed Journal

Low TEWL: < 10 g/m²/h
Moderate TEWL: 10 - 15 g/m²/h
High TEWL: 15 - 25 g/m²/h
Very High TEWL: > 25 g/m²/h
If you have specific TEWL results and need help interpreting them, please provide the values, and I can offer a more detailed analysis.

11. REFERENCES

1. *.Rothman, S. Physiology and Biochemistry of the Skin. The University of Chicago Press, Chicago.(1954).*
2. *Wilson, D. and Maibach, H. 1. Non invasive techniques (in vivo) for neonatal human skin. In: Models in Dermatology Vol. I. (Ed. by H. 1. Maibach and N. Lowe) 246-257 (1985).*
3. *De Jongh. G. J. Porosity of human skin in vivo assessed via water loss, carbon dioxide loss and electrical impedance for healthy volunteers, atopic and psoriatic patients. Curr. Probl. Dermatol. 9 83-101 (1981)*
4. *Scheuplein, R. and Blank. 1. Permeability of the skin. Physiol. Rev. 5702-747 (1971).*
5. *Jacques, S. Water content and concentration profile in human stratum corneum. Thesis (1982).*
6. *Rietschel, R. L. A skin moisturization assay. J. Soc. Cosmet. Chem. 30 369-373 (1979).*
7. *Jacques, S. L., Maibach, H. I. and Suskind, C. Water content in the stratum corneum measured by a focused microwave probe: normal and psoriatic. Bioeng. Skin. 3 118-119 (1981).*
8. *Miller, D. L.. Brown. A. M. and Artz, E. J. Indirect measures of transepidermal water loss. In: Bioengineering and the Skin. (Ed. by R. Marks and P. A. Payne) MTP Press, Lancaster. pp. 161-171 (1981). , C. G. T., Wilson, D. R. and Maibach, H. I. Transepidermal water loss as a function of skin*
9. *Alexander H, Brown S, Danby S, Flohr C. Research tech- niques made simple: transepidermal water loss measurement as a research tool. J Invest Dermatol. 2018;138(11): 2295-300.*
10. *Montero-Vilchez T, Segura-Fernández-Nogueras MV, Pérez- Rodríguez I, Soler-Gongora M, Martinez-Lopez A, Fernán- dez-González A, et al. Skin barrier function in psoriasis and atopic dermatitis: transepidermal water loss and temperature as useful tools to assess disease severity. J Clin Med. 2021; 10(2):359.*
11. *Akdeniz M, Gabriel S, Lichterfeld-Kottner A, Blume-Peytavi U, Kottner J. Transepidermal water loss in healthy adults: a sys- tematic review and meta-analysis update. Br J Dermatol. 2018; 179(5):1049-55.*
12. *Pinnagoda J, Tupker RA, Coenraads PJ, Nater JP. Trans- epidermal water loss with and without sweat gland inactivation. Contact Dermatitis. 1989;21(1):16-22.*
13. *Peer R, Burli A, Maibach H. Unbearable transepidermal water loss (TEWL) experimental variability: why? Arch Dermatol Res. 2021.*
14. *Imhof RE, De Jesus ME, Xiao P. Ciortea LI, Berg EP. Closed- chamber transepidermal water loss measurement: microcli- mate, calibration and performance. Int J Cosmet Sci. 2009; 31(2):97-118.*
15. *Thoma S, Welzel J, Wilhelm KP. Relationship between trans- epidermal water loss and temperature of the measuring probe. Skin Res Technol. 1997;3(1):73-80.*
16. *Tagami, H., et al. (2002). Measurement of water loss through the skin: TWEL (transepidermal water loss). In Current Problems in Dermatology (pp. 32-38). Springer.*
17. *Proksch, E., et al. (2008). The skin: an indispensable barrier. Experimental Dermatology, 17(12), 1063-1072.*
18. *Pinnagoda, J., et al. (1990). Guidelines for transepidermal water loss (TEWL) measurement. Contact Dermatitis, 22(3), 164-178.*
19. *Löffler, H., et al. (2003). Skin susceptibility of atopic individuals. Journal of the European Academy of Dermatology and Venereology, 17(2), 172-179.*
20. *Darlenski, R., & Fluhr, J. W. (2012). Influence of skin type, race, and gender on epidermal barrier function. Clinical Dermatology, 30(3), 269-273.*
21. *Farwanah, H., et al. (2009). Lipid composition and trans-epidermal water loss. Dermato-Endocrinology, 1(6), 274-280.*