



# Usage of thermal spring water for optimal skin health: bridging traditional therapy with modern dermatology

Pedro Emanuel Rocha<sup>1</sup> · Maria José Alves<sup>2,3,4,5</sup> · Cátia Fidalgo<sup>2,3</sup> · Daniela Correia<sup>2,3</sup> · Silvia Pedrosa<sup>1,6</sup> · Ana Raquel Madureira<sup>1,6</sup>

Received: 4 February 2025 / Revised: 24 February 2025 / Accepted: 21 March 2025  
© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2025

**Keywords** Skin health · Immunomodulatory · Anti-inflammatory · Skin barrier reinforcement · Cosmetic potential

To the Editor,

Thermal spring waters (TSW) have been employed for therapeutic purposes across the centuries being increasingly recognized for its unique benefits in skin health, in which immunomodulatory effects play a crucial role. By reviewing the literature, the multifaceted properties of TSW, which arise from its diverse mineral composition as well as its thermal characteristics, revealed the strong potential of these waters to aid in managing various chronic skin disorders, holding also a significant promise in cosmeceutical formulation.

Such a distinct mineral composition that includes chloride, bicarbonate, sulphate, magnesium, calcium, zinc, and selenium, contribute to their unique biological activities [1],

and are originated from the water–rock interactions that occur in geothermal environments resulting in a spectrum of therapeutic effects [2], including anti-inflammatory, immunomodulatory, and antioxidant actions [1]. These properties underpin the ability of TSWs to accelerate wound healing, reinforce the skin barrier and ameliorate symptoms related to atopic dermatitis, psoriasis and rosacea [3, 4].

Nonetheless, the major beneficial potential reported for such waters refers to their immunomodulatory properties which may act upon different targets of the immune system. For instance, recent studies demonstrated that TSW has the capacity to reduce maturation of dendritic cells and decrease the secretion of pro-inflammatory cytokines like IL-12 and IL-23 while simultaneously promoting the production of anti-inflammatory IL-10 [5, 6].

Beyond clinical applications, such properties also emerge as key aspects of the use of these waters as cosmeceutical products. Modern formulations from well-known brands incorporate TSW as an active ingredient enhancing skin hydration, elasticity and overall barrier function (Table 1) [1].

Our comprehensive review also highlighted that, although the beneficial effects of TSW are well-documented, the precise molecular mechanisms remain only partially understood. Further research is essential to dissect the complex interactions between the various minerals and the host immune system.

TSW represents a link between traditional natural therapies and their integration into modern dermatological treatments. The capacity to modulate inflammation reveals these waters as potential candidates as co-treatments of dermatologic conditions marked by the exacerbated inflammation of the skin tissue. We encourage further studies that explore the intricate mechanisms behind TSW's actions and its long-term benefits for skin health.

✉ Ana Raquel Madureira  
rmadureira@ucp.pt

<sup>1</sup> CBQF—Centro de Biotecnologia e Química Fina, Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Rua Diogo Botelho 1327, Porto 4169-005, Portugal

<sup>2</sup> AquaValor—Centro de Valorização e Transferência de Tecnologia da Água, Chaves, Portugal

<sup>3</sup> LiveWell - Research Centre for Active Living & Wellbeing, Instituto Politécnico de Bragança, Bragança 5300-253, Portugal

<sup>4</sup> CIMO - Centro de Investigação de Montanha, Instituto Politécnico de Bragança, Bragança, Portugal

<sup>5</sup> Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, Bragança 5300-253, Portugal

<sup>6</sup> Biorbis, Unipessoal LDA, Edifício de Biotecnologia da Universidade Católica Portuguesa, Rua Diogo Botelho 1327, Porto 4169-005, Portugal

**Table 1** Popular TSW-based products and their respective properties

Thermal Water	Geographic Origin	Mineralization (mg/L)	Properties
Avène	Haut-Languedoc Regional Natural Park, France	266	Immunomodulatory
La Roche-Posay	Vienne (department), France	440	Immunomodulatory and antioxidant
Uriage	French Alps, France	1100	Antioxidant and antimicrobial
Vichy	Auvergne Region, France	5200	Immunomodulatory, antioxidant and skin barrier reinforcement

**Acknowledgements** The authors are grateful to the Fundação “La Caixa” and to FCT for the financial support through Project “Therm4Skin– Bem-Estar Sem Pausa” Promove Piloto Inovador “O futuro do Interior”, call 2023.

**Author contributions** Conceptualization: P. E. R, A. R. M; Methodology: P. E. R; Writing: - Original Draft: P. E. R; Writing - Review & Editing: M. J. A, C. F, D. C, S. S. P, A. R. M.

**Data availability** No datasets were generated or analysed during the current study.

## Declarations

**Competing interests** The authors declare no competing interests.

## References

1. Figueiredo AC et al (2023) Thermal spring waters as an active ingredient in cosmetic formulations. *Cosmetics* 10(1):27
2. Olivier J, Venter J, Jonker C (2011) Thermal and chemical characteristics of hot water springs in the Northern part of the Limpopo Province, South Africa. *Water Sa* 37(4):427–436
3. Lee YB et al (2014) Immunomodulatory effects of balneotherapy with hae-un-dae thermal water on imiquimod-induced psoriasis-like murine model. *Ann Dermatol* 26(2):221–230
4. Bajgai J et al (2017) Balneotherapeutic effects of high mineral spring water on the atopic dermatitis-like inflammation in hairless mice via Immunomodulation and redox balance. *BMC Complement Altern Med* 17(1):1–9
5. Eliasse Y et al (2019) Effect of thermal spring water on human dendritic cell inflammatory response. *J Inflamm Res.* 12:181–194
6. Eliasse Y, Redoules D, Espinosa E (2020) Impact of Avène thermal spring water on immune cells. *J Eur Acad Dermatol Venereol* 34:21–26

**Publisher’s note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.