KIERETA, Kacper, CICHOWSKA, Zuzanna, CHMIELOWIEC, Laura, WACŁAWEK, Katarzyna, JANAWA, Kamil, CIESIELKA, Anna, BACIK, Małgorzata, RECHCIŃSKA, Aleksandra, GŁODOWSKA, Klaudia, RDZANEK, Bartłomiej Józef and ŻELAZO, Jakub. Balneotherapy in dermatology and rheumatology: a systematic review. Quality in Sport. 2025;42:60807. eISSN 2450-3118.
https://doi.org/10.12775/QS.2025.42.60807
https://apcz.umk.pl/QS/article/view/60807

The journal has been awarded 20 points in the parametric evaluation by the Ministry of Higher Education and Science of Poland. This is according to the Annex to the announcement of the Minister of Higher Education and Science dated 05.01.2024, No. 32553. The journal has a Unique Identifier: 201398. Scientific disciplines assigned: Economics and Finance (Field of Social Sciences); Management and Quality Sciences (Field of Social Sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).
The authors declare that there is no conflict of interest regarding the publication of this paper.
Received: 07.05.2025. Revised: 10.05.2025. Accepted: 16.06.2025. Published: 17.06.2025.

Balneotherapy in dermatology and rheumatology: a systematic review

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ABSTRACT

Objective: Article's aim is to characterize what a balneology is, what it consists of. To picture actual usage of balneotherapy in different fields of medicine; its possibilities and restrictions.

Methods: A vast literature review was conducted using PubMed database. Reviewed articles included systematic reviews, randomized controlled trials, observational studies and meta-analyses. Keywords included "balneology", "balneotherapy", "peloid baths", "water baths", "balneotherapy dermatology", "balneotherapy rheumatology".

Conclusions: Although balneotherapy might be considered as antiquated and according to some physicians, not scientifically proven, is efficient in reducing symptoms of some dermatological and rheumatological conditions due to its anti-inflammatory, keratolytic, antimicrobial, analgesic and myorelaxant effects. Albeit its role as complement therapy, it can achieve very good results alleviating pain and reducing amount of painkillers used, extending periods of remission or quality of live and well-being improvement.

Keywords: balneology, balneotherapy, peloid baths, water baths

1. Introduction

Balneotherapy is a medically recognized set of practices and methods that employ muds (peloids), natural gases and natural mineral waters. Baths used to be hygiene-promotion way in ancient Greece, wheras ancient Romans dicovered that baths may be useful in treating motor organ dysfunctions. It was forgotten during the middle ages but developed again in the Renaissance. Nowadays, grows in popularity. In most cases, balneotherapy is applied as a complementary therapeutic option to standard therapy, not a substitute. However, often can

achieve excellent results such as improving life quality in patients. It is used mostly in rheumatological and dermatological disorders, also as a method of pain relief. It is worth emphazising that it is a relatively safe treatment method, since usually is well-tolerated and adverse side effects are exceptional. Moreover, it has a hollistic effect on human organism [1]. Thermal baths may provide relaxing, healthy and stress-relief atmosphere. What is more, balneological resorts frequently offer psychological support through climate and environment. All these additional benefits should not be underestimated.

2. Peloids

Peloid therapy uses mineral and organic substances that have therapeutic features. In Poland, most often applied mud type is turf peat. This kind of peloid is created in a very long process of humification of plants, which occurs in an aqueous environment with limited oxygen availability and is facilitated by anaerobic bacteria. Therapeutic effect is possible due to natural thermal, mechanical and pharmacodynamical effects [2]. Because of low conductivity and high thermal capacity of peloids, deep and uniform overheat of the tissues is possible. Astringent and anti-inflammatory properties originate from micronutrients and humic acids that are present in muds. Treatment consists of wrapping up in pastes or baths, normally heated to 40-45°C.

3. Mineral waters

Medicinal waters are defined as natural waters containing minimum concentration of 1 gram per liter of dissolved minerals. Local traditions of the countries, lack of clear-cut data for specific substance concentrations that are accepted due to toxic features and pharmacodynamics result in different criteria for each country [3]. Composition of the waters is influenced by the type and structure of the geological formations they interact with, as well as by various hydrogeological processes such as weathering, leaching, sorption, oxidation-reduction reactions and hydrolysis. Physical factors like temperature and pressure also play a role. In evaluating these waters, key criteria include verifying their natural chemical and microbiological purity and quality, along with demonstrating their positive effects on human health. [4] Therapy consists of baths, inhalations or drinking medicinal waters.

4. Dermatology

4.1. Psoriasis

Psoriasis is a chronic, multifactoral disease that affects mostly skin, but as well joints and cardiovascular system. Hyperproliferation, alteration of keratynocite differentiation,

angiogenesis, immunological and autoimmunological factors play a major role in psoriasis pathophysiology. Although introducing new methods of treatment, psoriasis still remains an uncurable condition. Balneotheraphy's therapeutical effect is multifactoral. Bathing in highly mineralised brine waters mechanically triggers plaques to remove, which increases skin's vulnerability to the ultraviolet radiation. Moreover, saline waters have antiseptic and reducing properties. Probably they elute pro-inflammatory and chemotactic factors that are present in epidermis and enhance local and general immunosupresive effect of the ultraviolet radiation [5]. In most cases of balneologically treated psoriasis tissue alterations subside in histopatological examination of skin samples. Normalization of CD4:CD8 ratio is observed as well [6]. Chemical elements that are present in brine or saline water may enter transdermally to epidermis and have a therapeutic properties. It relates to chlorine, potassium, sodium, bromine, boron, cadmium, rubidium and especially – magnesium ions [7]. Magnesium ions *in vitro* inhibit proliferation of psoriatic epidermis, reduce 5-lipoxygenase activity and may modulate Langerhans cells' activity. In addition, psoriatic patients may benefit from high magnesium ions levels in a neurological aspect, because in clinically symptomatic psoriasis hyperactivity and stress tendency is observed due to hypomagnesemia. Sulfates, selenium and strontium reduce cytokines production by Th1 lymphocytes and keratinocytes [8]. Balneotherapy concentrates on decrease of inflammation, pruritus and psoriatic scale. Erythrodermic and pustular psoriasis are contraindicated to balneotherapy.

Numerous prospective and retrospective studies established that sulfur-rich termal spring water of the Dead Sea was effective in treating psoriasis reducing PASI (Psoriasis Area and Severity Index) by 34,8% [9].

Different trial from France (Salies de Béarn) that included 71 patients (PASI >10) showed PASI decrease of 29%. These waters have magnesium concentration of 980 mg/L and sodium concentration of 250 g/L. It is worth noting that combination of balneotherapy and UVB 311-nm phototherapy accomplished 55% PASI reduction, hence phototherapy considerably enhances effects of balneotherapy [10].

Another study from Italy demonstrated that arsenical-ferruginous Levico and Vetriolo water decreased psoriatic lesions (mild and moderate) in 34 patients. These waters have high concentration of iron, sulphates and pH of 1.6. In addition, they contain high concentrations of arsenic which may probably induce apoptosis of keratinocytes [11].

4.2. Atopic dermatitis

Atopic dermatitis is a chronic, recurrent inflammation of the skin. Patients are prone to *Staphylococcus aureus* superinfections and suffer from xerosis and pruritus. Balneotherapy minimizes inflammation, moistures skin and, due to bactericidial effect, reduces *Staphylococcus aureus* colonization. Acute dermatitis flares are contraindicated to balneotherapy.

A trial from the Dead Sea of 1408 patients which suffered from atopic dermatitis demonstrated complete cleareance of lesions in 90% of patients [12].

Another study from La Roche-Posay, France showed crucial improvement of disease symptoms in 88 patients with atopic dermatitis. Patients enhanced Eczema Area and Severity Index (EASI) scores and Dermatology Life Quality Index (DLQI) scores. Xerosis and itching lessened as well. Thermal spring water from La Roche-Posay is rich in strontium, magnesium, silicate, calcium, bicarbonates and selenium [13].

4.3. Other skin diseases

Acne vulgaris results in a non-inflamatory or inflammatory lesions. It afects pilosebaceous units. Therapy's aim is to target its factors, such as inflammation, abundant sebum production, enhanced *Cutibacterium acnes* proliferation and irregular follicular desquamation. Therapeutical potential of thermal waters lies in anti-inflammatory and immunomodulant properties. What is more, sulfuric thermal water has a keratolytic effect, so a follicular obstruction can be restrained due to peeling [14]. Warm black mud from the Dead Sea may trigger pilosebaceous orifices to open and to perspire. It also has an antimicrobial properties. *Cutibacterium acnes* bacteria lose their viability when are added to the mud. Moreover, inhibition zone of growth is observed when mud is placed on inoculated agar plates [15]. Balneotherapy might be a sensible therapeutic option in acne patients as part of multimodal therapy, notably during summer because then most systemic and topical therapies are contraindicated.

Seborrheic dermatitis is characterized by erythema and yellowish and oily scaling. *Malassezia* yeasts play an important role in this condition causing hyper-proliterative and inflammatory response from epidermis. That is why keratolytic, antibacterial and anti-inflammatory properties of thermal waters may have a massive effectiveness for seborrheic dermatitis [16].

Ichthyoses is a family of genetic diseases that affect differentiation of keratinocytes. The treatment is only symptomatic and consists of moisturizing the skin, taking baths to soften and release scale and applying retinoid ointments. Balneotherapy, using water with high

quantities of sodium chloride might be very useful in this condition [17]. Unhealed wounds, varicose veins, hypersensitivity to mineral waters are contraindications to this type of therapy.

5. Rheumatology

5.1. Rheumatoid artritis

Rheumatoid artritis is the most common rheumatic disease. Idiopathic, autoimmune symmetrical artritis is the most characteristic symptom, it may also affect other organs leading to disability. Potential profitable effect of the balneotherapy during treating rheumatoid artritis originates from couple mechanisms. First of all, sulphuric compounds that are present in medicinal waters are absorbed and then used as substrates for chondroid tissue (chondroitin sulphate)[18]. Anti-inflammatory effect is achieved through increase of sulfhydryl groups, superoxide dismutase and catalase levels, which are present in synovial fluid. Concentration of free radicals is lowered thanks to these enzymes resulting in beneficial oxidative reactions in cells [19]. Decrease of smooth muscles tension in vessels results in analgesic effect. Clinical effects of balneotherapy are: improvement of grip strength and joints mobility, morning stiffness decrease.

In a trial conducted in Germany, 60 patients with rheumatoid artritis were divided into control and experimental group [20]. Control one received baths in water artificially carbon dioxide-impregnated. The experimental one was bathing in radon water. This type of water contains radioactive radon. According to the radiation hormesis theory, small doses of ionizing radiation may stimulate mechanisms of cell repairs [21]. However, this hypothesis is not completely confirmed yet. What is true is that after 6 months overall improvement in quality of life, relief in pain and enhanced joint mobility in experimental group persisted, while in control group it was only short-term, right after the study.

Study from 2016 investigated 44 rheumatoid artritis patients [22]. 22 patients were asigned to experimental group which received pharmacotherapy combined with balneotherapy (sulphur baths, 30 minutes and 34°C or 20 minutes and 37°C). Control group of 22 patients received their usual pharmacotherapy. Health Assessment Questionnaire – Disability Index (HAQ-DI) results improved right after the trial and continued up to 3 months in experimental group.

5.2. Ankylosis spondylitis

Ankylosis spondylitis is a chronic, progressive and inflammatory disease that affects mostly sacroiliac joints, vertebral joints, anulus fibrosus and vertebral ligaments resulting in their gradual stiffness. Therapy’s aim is to maintain functional ability, alleviate stiffness and pain as

well as conserve axial spine mobility. A couple of mechanisms may play role of balneotherapy's analgesic effect. Affected region is purified from alogenic substances due to vasodilation triggered by heat. It also triggers muscles to relax stimulating of the type Ib fibers and reflex of the golgi tendon organ. In addition, loss of muscle tone is another, but indirect analgesic effect [23]. Gaseous compounds, salts and minerals, after absorbtion through skin are transported by lymphatic vessels and blood to relevant body parts. There, they can regulate skin metabolism and immunological processes due to stimulating secretion of serotonin, bradykinin, histamine and acetylcholine [24]. Anti-inflammatory properties of some brine waters are also crucial for rheumatic diseases.

Van Tubergen et al. study that analysed two groups of patients (exercise therapy combined with spa treatment and exercise therapy only), 40 patients each, showed crucial improvement of indexes (global well-being, functional ability, morning stiffness, pain) in dual therapy group up to 28 weeks [25].

Different trial from Türkiye demonstrated beneficial effects of balneotherapy on patient's evaluation, spine motility, morning stiffness, pain and functional index [26]. Effect were evident up to 6 months. In this study participated 61 patients and were divided into 3 groups: balneotherapy group (21 patients, 20 minutes, once a day, 5 times a week, during 3 weeks), non-steroid anti-inflammatory drug group (NSAID)(20 patients, 1000mg of naproxene, once a day, 5 times a week, during 3 weeks) and balneotherapy with NSAID combined (20 patients). Clinical parameters were the most favorable in balneotherapy and balneotherapy+NSAID group.

Another trial conducted in Italy showed significative enhancement of Health Asessment Questionare (HAQ), Visual Analogue Scale (VAS) for back pain and Bath Ankylosing Spondylitis Functional Index (BASFI) and effects persisted up to 6 months [27]. 15 patients attended in experimental group, therapy consisted of TNF inhibitors administration and 10 sessions of mud baths combined with thermal water kinesiotherapy. Control group of 15 patients was only TNF inhibitors-treated.

5.3. Fibromyalgia

Fibromyalgia is characterized by general, chronic musculoskeletal pain that is acompannied by fatigue, cognitive impairment and sleep disorders. Therapy is multidisciplinary and consists of a combination of pharmacological (miorelaxants, analgesics, anti-depressants) and non-pharmacological methods (for example, kinesytherapy). Positive analgesic and

miorelaxant effect of balneotherapy originates from similar mechanisms that are described in ankylosis spondylitis [1].

Fioravanti et al. investigated 80 patients that suffered from fibromyalgia [28]. Patients were divided into two equal groups. Experimental group participated in 12 mineral water baths (10 minutes, 37°C) combined with mud compress therapy (15 minutes, 45°C) and pharmacotherapy (ant-depressants, miorelaxants, analgesics). Control group received pharmacotherapy only. After 16 weeks, results were evaluated. Significant improvement of VAS, Tender Point Count (TPC), Fibromyalgia Impact Questionnaire (FIQ), Arthritis Impact Measurment Scale (AIMS) and HAQ indexes was observed only in the experimental group. These beneficial effects persisted right after the study and 16 weeks later.

Another study from Türkiye tested 50 women with fibromyalgia and separated them into two equal groups [29]. Mineral water baths (20 minutes, 36-37°C) were performed in experimental group. Control group did not receive any procedures. Study lasted 2 weeks, whilst observation time – 3 months. VAS, FIQ, TPC, Beck Depression Inventory (BDI), Investigator's Global Assesments (IGA), Short Form Health Survey (SF-36) parameters significantly increased in the experimental group. Effects persisted up to 3 months, however BDI's improvement time was shorter.

Experimental group of 20 fibromyalgic patients that was treated with mineral baths (20 minutes, 36°C) was compared to equal control group which did not receive balneological treatment in Ardiç et al. study [30]. After 3 weeks of trial, improvement of VAS, TPC, FIQ, BDI parameters was observed. What is more, concentration of inflammatory state markers in serum was measured before and after balneotherapy. Levels of prostaglandin E2, interleukin 1 and luecotriene B4 were lower at the end of the therapy.

Summary: Balneotherapy is a set of practices that uses peloid baths, natural mineral waters baths and natural gases. It may serve as important addition to medication and physical therapy, greatly enhancing quality of life for patients. Beneficial effects are observed especially in psoriasis and atopic dermatitis, moreover balneotherapy might be useful in acne vulgaris, seborrheic dermatitis and ichtyoses. In case of rheumatology, positive influence is noted in rheumatoid artritis, ankylosis spondylitis and fibromyalgia. Albeit its role as complement therapy, it can achieve very good results alleviating pain and reducing amount of painkillers used, extending periods of remission or quality of live and well-being improvement.

Disclosure

Authors do not report any disclosures

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All authors have read and agreed with the published version of the manuscript.

Funding Statement

Study received no external funding

Institutional Review Board Statement

Not applicable

Data Availability Statement

Not applicable

Acknowledgements

Not applicable

Conflict of Interest Statement

The authors of the paper report no conflicts of interest

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