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Review Article

Balneotherapy in the recovery of patients with rheumatoid arthritis - A Systematic Review

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Abstract: Rheumatoid arthritis (RA) is the most common autoimmune disease, with a chronic course, systemic involvement and potentially debilitating. Given the severe natural course of the disease, a complex therapeutic approach is needed that aims to control the progression of the disease, but also to improve symptoms. Modern pharmacological treatment available for treating RA has some limitations in terms of therapeutic targets in some patients. Therefore, balneotherapy is seen as a possible adjuvant treatment, with beneficial effects on symptoms, functionality and quality of life. This systematic analysis follows the effects of balneotherapy treatment in patients with RA reported in the literature. Ten clinical studies on human subjects, which have balneotherapy as an intervention, were analyzed to see the benefits of this treatment in RA. The results indicate favorable effects on pain relief, improvement of functionality and decreased use of analgesics and anti-inflammatories. The evidence found supports the integration of balneotherapy as an adjuvant therapy in the management plan of patients with RA.

Keywords: rheumatoid arthritis, balneotherapy, treatment, quality of life, pain.

1. Introduction

Rheumatoid arthritis (RA) is the most common autoimmune disease [1], with a chronic course, systemic involvement and the potential for joint destruction and disability [1,2]. The typical form of the disease manifests itself through symmetrical arthritic involvement of the small joints of the upper and lower limbs, which is accompanied by prolonged morning stiffness [3,4]. Initially, the affected joints show classic inflammatory signs, such as swelling, tenderness and limitation of mobility [3,4]. In the absence of modern treatments, these changes can lead to joint destruction and deformities [3,4]. In addition to joint involvement, the disease is frequently accompanied by damage to the skin, eyes, lungs, heart, kidneys and nervous system [3,5]. Untreated, the disease has a major impact on life, as it influences both the functionality and the psyche of the patient. This significantly contributes to the decrease in quality of life (QoL), but also has effects on their work capacity and social life [3,4,6].

Given the dramatic natural course of the disease, a complex and individualized therapeutic approach is necessary, with rapid control of the inflammatory process being the main goal [7]. This, together with the improvement of symptoms, are the objectives pursued by modern pharmacological management, which ultimately aim to maintain optimal functionality and increase the QoL [7,8]. Although pharmacological treatments have made remarkable progress, it has been observed that the initial therapeutic objectives are not achieved by a significant number of patients [9,10]. It is necessary to integrate non-pharmacological, complementary strategies, such as

balneotherapy, into the care plan, which aim to reduce symptoms, reduce joint limitations and improve well-being [10-12]. Balneotherapy is a traditional method of treatment of musculoskeletal conditions, including RA. In the management of RA, especially in stable or low-activity forms, balneotherapy aims to relieve pain, improve functionality and increase the QoL [11,12]. Together with other complex care strategies, such as physiotherapy, kinesitherapy, complementary therapies, it complements drug treatment, which leads to achieving therapeutic goals and improving quality of life [9,10].

Existing clinical studies have shown that balneotherapy in patients with RA has been shown to reduce pain, reduce the number of tender joints, increase functionality, improve the disability score (HAQ-DI), and improve general well-being [2,12]. However, limited methodologies and small samples have led to a low level of solid evidence in systematic analyses. Even so, by associating balneotherapy with physical exercises and other recovery interventions, it has been confirmed that there are clinical and functional benefits of it in the treatment of RA [11,12]. This highlights the need for further and rigorous evaluation of the effects of balneotherapy in patients with RA, in order to be integrated in the best possible way into the therapeutic management of this pathology [11,12].

2. Materials and methods

2.1 Inclusion and exclusion criteria

To perform this analysis, studies were selected according to well-established inclusion and exclusion criteria, detailed in Table 1, taking into account the type of diagnosis, characteristics of the included population, research topic, stage of studies, language of publication, objectives pursued and publication period.

Table 1. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Adults (>18 years) diagnosed with clinically confirmed RA	Animal studies
	Studies published in languages other than English or Romanian
Research conducted exclusively on human subjects	Papers or with no results available
	Evaluation of other rheumatological conditions, excluding rheumatoid arthritis
Diagnosis confirmed for at least 6 months	Clinical guidelines, editorials, and letters were excluded
Pathology studied: Rheumatoid arthritis	Studies published before January 1, 2013
Studies completed and with available results	Duplicate studies were eliminated
Studies published in English or Romanian	Studies not primarily focused on the research topic
Inclusion of studies that did not obtain statistically significant results	Studies with insufficient samples (<5 patients) or unclear methodology
Effects of balneotherapy on patients with RA	
Balneotherapy recovery programs were applied to at least a proportion of the included patients	
Intervention evaluated in the short and medium term	
Studies published between 01.01.2013 and until 01.07.2025	
Studies without major conflicts of interest	

2.2 Search strategy

This review was conducted as a systematic analysis of the literature without meta-analysis. Relevant articles were identified through a systematic search performed in PubMed, Embase, and Google Scholar, focusing on peer-reviewed publications written in English between January 2013 and July 2025.

In selecting the studies included in this analysis, the databases PubMed/Medline, Embase (Elsevier) and Google Scholar were accessed, but the bibliographies of relevant articles were also manually searched. The following main terms were used, together with synonyms and MeSH terms to obtain the most comprehensive number of results: "rheumatoid arthritis", "Arthritis, Rheumatoid", "Balneology", "balneotherapy", "spa therapy", "Thermal therapy", "Mud therapy", "pelotherapy", "rehabilitation", "functional improvement", "quality of life", "patient recovery", "treatment outcome". Searches were restricted by language, full text, by the filter of "people" and were limited to the publication period between January 1, 2013 and July 1, 2025. The searches were last updated on July 1, 2025. In addition, the PICO strategy was used to identify studies: population (P) – patients diagnosed with RA; intervention (I) – balneotherapy programs; comparison (C) – standard treatments or control groups; outcomes (O) – physical recovery, functionality and quality of life. Through this strategy, relevant studies were identified that evaluate the effect of balneotherapy in the recovery of patients with RA, taking into account the inclusion and exclusion criteria.

The identified studies were assessed for eligibility according to pre-established criteria. Initially, the titles and abstracts of all articles were examined to determine whether the studies corresponded to the topic and parameters analyzed. Studies that did not meet these conditions were eliminated from the analysis. Next, studies considered eligible based on the abstract were reviewed in full to confirm that they met the selection criteria and were included in the analysis. Promising studies that were excluded were documented for transparency of the process.

The following elements were recorded for each eligible article: selection criteria, main author and year of publication, included population, number of participants per group, study design, applied intervention, main effect assessed and side/additional effects.

Given the significant differences between studies, related to the duration, frequency and intensity of balneotherapy programs, application intervals, the way of expressing the results was standardized. The main effects that were evaluated are functional recovery, increased mobility and exercise capacity, pain relief and improved quality of life. These effects were quantified using specific scales, adapted to the parameters of the disease. Continuous data were expressed by the difference in means, accompanied by the standard deviation, both before and after the intervention. For binary data, the effect was expressed by the odds ratio/relative risk. The statistical significance of the differences was indicated by p-values, which were compared with the standard thresholds of 0.05 or 0.01 (95% CI), which allowed a rigorous assessment of the variation between the intervention and control groups.

3. Results

After consulting the above-mentioned databases, 182 potentially eligible articles were identified. From other additional sources, 5 clinical trials and one prospective study were added. To these articles, obtained through the PICO method and using MeSH terms, the following filters were applied: availability of full text, studies conducted exclusively on human population, publication language: English or Romanian, which resulted in a total of 63 papers. For a better understanding of the process of identifying the 10 studies included in the present analysis, we used a PRISMA representation (Figure 1).

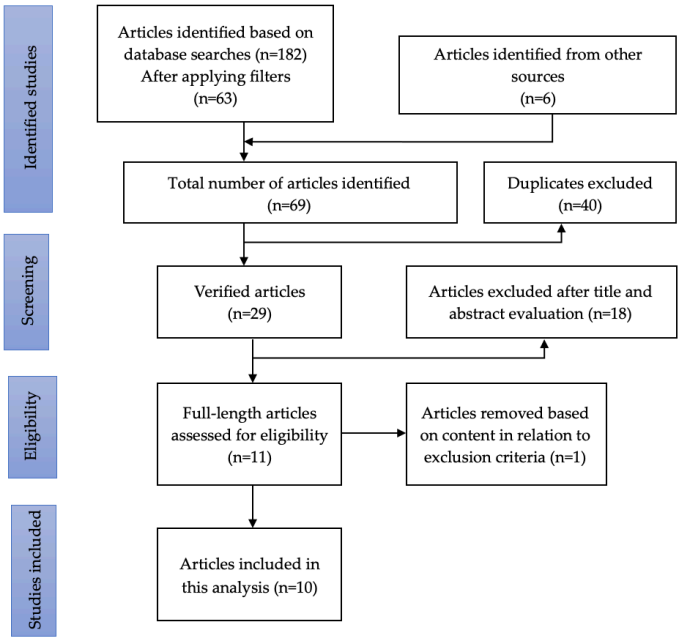

Figure 1. PRISMA representation for systemic analyses, including articles from databases and additional sources

A total of 178 studies were excluded from the total of 182 initially identified. In this process, the eligibility criteria were successively applied. Figure 2 details the process of excluding ineligible studies. Studies that seemed promising at first glance were excluded because they did not fall within the established publication period (January 1, 2013-July 1, 2025), were included in the category of clinical guidelines, the effects pursued were not those established as relevant for this analysis or they address balneotherapy in RA in a general manner.

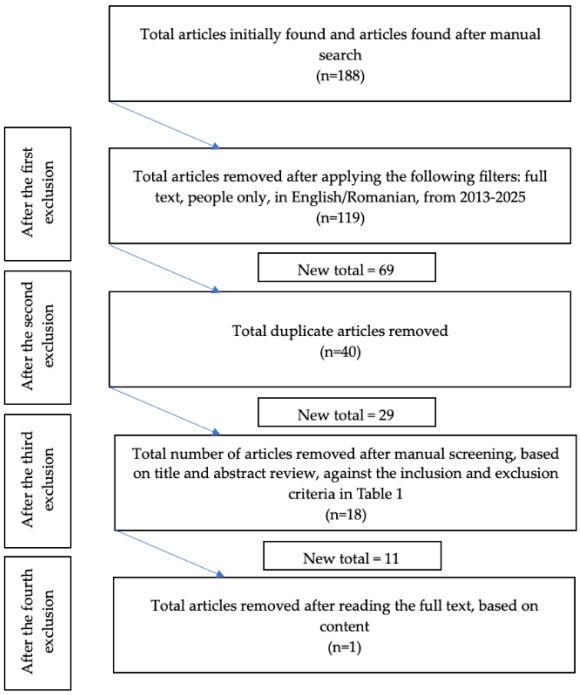

Figure 2. Graphical representation of the process of excluding ineligible studies.

After the process of selection, a total of 10 studies (2 prospective longitudinal studies, 6 clinical trials, 1 retrospective longitudinal study, and 1 systematic analysis from which only a clinical trial was considered for this paper) were included in the analysis. The characteristics of the studies included in this analysis are detailed in Table 2, and the results of each study are presented in Table 3.

Tabel 2. Characteristics of the studies included in this analysis.

No	Author and year of publication	Type of study	Proposed intervention	Population included	Batch size	Frequency of interventions	Main effects studied
1	SM Pantovic et al 2024 [13]	Prospective longitudinal study	Peloid therapy combined with aromatherapy	Patients >18 years old with RA, admitted to the "Dr Simo Milosevic" Institute	N = 20 patients, F = 16 M = 4	D = 28 days, peloidotherapy on different parts of the body for 15 min/day and aromatherapy 20 min/day by applying essential oils, in a bath of 36-37o C	Laboratory results monitored: inflammatory and oxidative stress markers (e.g. IL-6, nitric oxide/NO, CRP, ESR, fibrinogen, Hsp-72 and hemogram parameters), measured before and after the treatment period.
2	F Annegret et al 2013 [14]	Multicenter clinical trial	Radon therapies (radon baths, speleotherapy) compared to tap water baths / artificial CO2 baths, etc., depending on the center)	Patients with chronic rheumatological diseases (low back pain, OA, RA, ankylosing spondylitis and others) from 7 health centers in Germany and Austria	N = 681 patients, divided into 2 parallel groups by 1:1 randomization	Protocol: intervention group: 12 regional radon baths applied over 3–4 weeks (frequency: every 2–3 days, 20 min; at a temperature of 36-38°C) or control group: control baths (with tap water), under conditions as similar as possible	Primary outcome: self-assessed pain (measured before, immediately after and at 3, 6, 9 months); secondary outcomes: improvement in quality of life, functional capacity (through specific scales used: HAQ/BASFI) and reduction in analgesic consumption.
3	M Karagulle et al 2017 [15]	Retrospective longitudinal study	Balneary programs applied twice a day, Turkish baths, peloid therapy, massage, kinetotherapy	Patients with various rheumatic and musculoskeletal conditions (OA, RA, low back pain, fibromyalgia, etc.); RA subgroup reported separately in analysis	N = 819 patients included in retrospective analysis, followed from 2002-2012	Typical 2-week programs, with measurements taken pre and post treatment through specific questionnaire	Pre/post-spa outcomes assessed: pain intensity (no RA results), patient global assessment (self-rated VAS), physician global assessment (therapist-rated VAS), functional status (HAQ) and, where appropriate, specific indices (WOMAC, Lequesne, NPDS, SDQ, FIQ) plus Beck Depression Inventory (BDI) in relevant subgroups.
4	M Fernandez-Gonzalez et al 2021; 2018 [16]	Systematic Analysis, of which only one randomized clinical trial was included	Sand bath, followed by olive oil massage, applied daily for 7 days. Procedure: pit dug 20–40 cm deep and patient covered up to neck level; sand temperature at surface: 75–82 °C and 10–20 cm below surface: 50–60 °C	Patients with RA diagnosed according to ACR 2010 criteria, adults aged 20 to 50 years; patients on stable treatment with DMARDs and NSAIDs	N = 30 patients (Group A Siwan n = 15; Group B conventional physiotherapy n = 15), all randomized patients completed the study	Group A (Siwan): sand bath + olive oil massage daily for 7 days (~20 min sessions in hot sand). Group B (active control): conventional physical therapy for two months, applied on alternate days (heat application, TENS, physical exercises)	Primary outcome: pain severity measured (measured by VAS); secondary outcome: disability/functioning (measured by HAQ).

5	O Aktas et al 2025 [17]	Randomized clinical trial	Warm hand and foot baths: warm salt water – 280g salt for 8 L water (95-98% NaCl) (WSW) vs warm water (WW) vs control group (no treatment);	Adult patients with RA divided into 3 groups, who performed home sessions based on a video protocol	N = 54 (18 WSW, 18 WW, 18 control)	6-week program of hand and foot baths (parameters monitored: temperature, salt dose, etc.) with pre- and post-intervention measurements	Outcomes: pain (VAS), fatigue (BRAF-MDQ / VAS), disease activity (DAS-28), sleep quality (PSQI) and functional capacity (HAQ).
6	M Karagulle et al 2017 [18]	Randomized clinical trial	Tuzla Salt Baths, Istanbul (body soak ~20 min, 2 weeks)	Adult patients with RA treated with usual pharmacological therapy,	N = 50 (25 had pharmaceutical treatment and 2 weeks of balneotherapy; 25 only pharmaceutical treatments)	2-week spa course (salt water immersion 20 min, 6 days per week), assessments at admission, 2 weeks, 3 months and 6 months; 37 completed period 1 (intervention group VS control group, with assessment at 2 weeks, 3 months, 6 months), 9-month washout, and 29 completed period 2 (intervention group VS control group, reassessed in the same way) 2 weeks of spa treatment, with extended follow-up at 12–15 months according to the extended crossover design	Outcomes assessed at baseline, at the end of treatment (2 weeks), at 3 and 6 months: pain (VAS 100 mm), patient global assessment (PtGA, VAS), physician global assessment (PhGA, VAS), Health Assessment Questionnaire (HAQ) and Disease Activity Score (DAS28-ESR).
7	M Karagulle et al 2018 [19]	Prospective longitudinal study	Long-term results (after 15 months) of the study presented in subsection 6	The same patients in the crossover cohort, analyzed over long periods	50 patients randomized, of whom 37 completed the first period and washout phase (15-month analysis), and 29 completed the second period and extension phase (12-month analysis)	2-week spa course (salt water immersion 20 min, 6 days per week), assessments at admission, 2 weeks, 3 months and 6 months; 37 completed period 1 (intervention group VS control group, with assessment at 2 weeks, 3 months, 6 months), 9-month washout, and 29 completed period 2 (intervention group VS control group, reassessed in the same way) 2 weeks of spa treatment, with extended follow-up at 12–15 months according to the extended crossover design	Long-term follow-up outcomes: number of tender joints, number of swollen joints, pain (VAS), patient global assessment, physician global assessment, function (HAQ) and acute phase reactant (ESR/CRP) used in the DAS28 calculation.
8	FD Guneri et al 2021 [20]	Randomized clinical trial	Peloid therapy plus conventional treatment vs conventional treatment	Patients >18 years with RA according to ACR-EULAR criteria admitted to the balneotherapy unit of a medical school	N = 56 allocated into two groups; intervention group = 28 patients	The experimental group benefited from daily peloid therapy in addition to the basic treatment, the mud used was enriched with mineral waters rich in sodium chloride from the Tuzla Spa Center.	Outcomes assessed: disease activity and symptom indicators (DAS28 and associated measures), pain, global assessments, function (HAQ) and inflammatory markers (CRP, ESR) with measurements at the end of treatment and at 1 and 3 months post-treatment

9	I Santos et al 2016 [2]	Randomized clinical trial	Sulfuric water baths applied in the resort	Adult patients with RA diagnosed according to ACR criteria, followed at Oporto Centre Hospital	N = 44 (22 spa group/ 22 control); there were 3 interruptions mentioned	21-day spa treatment with daily treatments; assessments on day 0, day 21 (end of treatment) and follow-up at 3 months	Primary outcome: self-assessment of disability (HAQ-DI); secondary outcomes: patient-reported VAS for pain, fatigue and quality of life, physician-reported VAS for global assessment, DAS28 and complementary investigations (joint ultrasound, laboratory analyses).
10	M Karagulle et al 2016 [21]	Randomized clinical trial	Balneotherapy in thermal saline water (baths, ≈12 sessions in 2 weeks, 20 min each)	Adult patients with RA treated with conventional DMARDs	Randomized 50 (25 spa / 25 control); from the PRISMA diagram it results that 15 from the spa group and 22 from the control group were analyzed in the study	Most patients in the spa group had 8–12 sessions; the mineral water used in the spa is salt water, with a concentration of 1.9 g/L sodium chloride (NaCl), also containing minerals such as magnesium and calcium.	Main measurements: oxidant/antioxidant status (biochemical markers, including NSSA/non-enzymatic superoxide radical scavenger activity); clinical measurements: pain (patient VAS), patient and physician global assessments (VAS), HAQ-DI and DAS28-4(ESR).

*Legend: RA – rheumatoid arthritis, N – total number of patients included, F – number of female patients, M – number of male patients, D – follow-up duration, IL – interleukin, , OA – osteoarthritis, HAQ – Health Assessment Questionnaire, BASFI – Bath Ankylosing Spondylitis Functional Index, VAS – visual analogue scale, WOMAC – Western Ontario and McMaster Universities Osteoarthitis Index, NPDS – Northwick Park Dependency Score, SDQ – Strength and Difficulties Questionnaire, FIQ – Fibromyalgia Impact Questionnaire, BDI – Beck Depression Inventory, ACR – American College of Rheumatology, WSW – Warm Salt Water, WW – Warm Water, TENS – Transcutaneous electrical nerve stimulation, BRAF-MDQ – Bristol Rheumatoid Arthritis Fatigue Multidimensional Questionnaire, DAS-28 – Disease Activity Score, PSQI – Pittsburgh Sleep Quality Index, CRP – C-reactive protein, ESR – erythrocyte sedimentation rate, Hsp-72 – heat shock protein, HAQ-DI – Health Assessment Questionnaire–Disability Index, NSSA – Nonenzymatic Superoxide Scavenger Activity

Table 3. Individual results of each study included in the analysis.

No	Author and year of publication	The results of the individual studies
1	SM Pantovic et al 2024 [13]	The results of the study showed that, although the blood count parameters did not show significant changes, a statistically significant decrease was found in serum concentrations of IL-6 and NO ($p = 0.001$ and $p = 0.002$, respectively), markers involved in the pathogenesis of inflammation in RA. Correlation analyses revealed an association between the reduction of CRP levels and sedimentation rate (SE = -0.045), as well as between fibrinogen (FIB = -0.008), IL-6 (IL-6 = 0.015) and NO (NO = 0.011).
2	F Annegret et al 2013 [14]	The results of the study did not reveal significant functional benefits for rheumatoid arthritis patients treated with radon therapy. Although the general group showed improvements in pain ($p = 0.032$) and reduced analgesic consumption ($p = 0.007$), these effects were not confirmed specifically for RA patients.
3	M Karagulle et al 2017 [15]	Regarding the subgroup of patients with RA, the statistical analysis did not reveal a significant reduction in pain scores after the spa treatment ($p = 0.134$), unlike the general study population ($p < 0.001$). Also, the general assessment made by the patients (VAS) did not show statistically relevant improvements ($p = 0.124$), contrary to the results obtained for the entire sample ($p < 0.001$). In contrast, the general assessment made by the doctors showed a significant decrease in scores for the entire group ($p < 0.001$), but without data reported as significant for patients with RA.
4	M Fernandez-Gonzalez et al 2021; [16]	Comparing the groups at the end of the program, the authors report significant differences in pain reduction and HAQ in favor of the Siwan group ($P < 0.05$) according to the primary outcome presented. In the pre- vs. post-treatment analysis, Group A (Siwan) showed greater improvements: ~50% pain relief and ~53.14% functional disability compared to the traditional program (37.01% and 13.19%, respectively). At inclusion in the study, the two groups had similar baseline values ($P > 0.05$ for demographic characteristics and baseline scores) and all randomized patients completed the study. Limitations noted by the authors: absence of a control group without intervention (they did

		not want to leave patients untreated), small sample size, and lack of secondary measures (e.g., muscle strength, quality of life)
5	O Aktas et al 2025 [17]	Warm salt water baths may be an effective adjunctive method for symptom relief in RA, with significant benefits in symptom reduction and functional capacity improvement. Mixed ANOVA analysis shows significant Group × Time interactions for pain ($F = 9.736$, $P < 0.001$, $\eta^2 = 0.249$), fatigue ($F = 4.323$, $P = 0.013$, $\eta^2 = 0.158$) and fatigue-related quality of life ($F = 3.350$, $P = 0.043$, $\eta^2 = 0.116$). Bonferroni post-hoc tests show that both interventions (WSW and WW) led to significant improvements compared to control for pain, fatigue and sleep quality (post-hoc $p < 0.05$). PSQI (sleep): significant improvement in WSW $t = -3.047$, $p = 0.002$ and in WW $t = -2.251$, $p = 0.024$ according to the excerpts provided. HAQ (functionality): significant pre-post improvement in WSW ($p = 0.026$)
6	M Karagulle et al 2017 [18]	A two-week balneary treatment, combined with standard medical treatment, can bring clinical benefits to patients with rheumatoid arthritis, maintained for up to 6 months. Immediate effect (at 2 weeks): significant pain reduction vs control (pain, median change at 2 weeks $p = 0.003$). At 3 months: significant persistence in the physician's global assessment $p = 0.010$ and trends in favor of the spa group for patient assessment $p = 0.058$, function $p = 0.092$ and disease activity $p = 0.098$ in the provided fragments. At 6 months: the authors report significant improvements for DAS28 $p = 0.006$ and for patient/physician assessments (patient $p = 0.020$; physician $p = 0.011$) and a trend in pain reduction ($p = 0.069$) and in the reduction of swollen joints ($p = 0.070$)
7	M Karagulle et al 2018 [19]	The results of the study showed that, after 15 months from the first allocation, no statistically significant differences were found between the groups for any of the efficacy parameters analyzed ($p > 0.05$). In contrast, after 12 months from the second allocation, following crossover, significant decreases were recorded in the global assessment scores made by patients ($p = 0.016$) and physicians ($p = 0.003$), as well as in the number of swollen joints ($p = 0.030$). No significant differences were found for the other parameters analyzed ($p > 0.05$). These results suggest that the observed short- and medium-term benefits of the balneal treatment can be moderately maintained up to 12 months, but further studies on larger samples are needed to confirm these conclusions.
8	F Demircioglu et al 2021 [20]	The results showed that although at 3 months the proportion of patients with low disease activity did not differ significantly between groups (9/29 vs. 4/27, $p = 0.15$), peloidotherapy brought significant benefits in terms of secondary indicators. Thus, HAQ scores were improved throughout the follow-up period ($p = 0.007$ at the end of treatment and at 1 month; $p = 0.040$ at 3 months). Also, at 3 months, the peloidotherapy group showed significant reductions in pain ($p = 0.028$), patient ($p = 0.028$) and physician ($p = 0.030$) global assessment, as well as DAS28 score ($p = 0.049$), with no differences between groups for ESR and CRP.
9	I Santos et al 2016 [2]	Results showed that HAQ-DI scores improved significantly in the spa group, both at the end of the 21-day treatment period (odds ratio 0.37, CI 0.09–0.64, $p = 0.01$) and at the 3-month follow-up (odds ratio 0.44, CI 0.15–0.72, $p = 0.004$). HAQ-DI: difference in favor of the spa group at the end of treatment +0.37 (95% CI 0.09–0.64), $P = 0.01$. HAQ-DI at 3 months: +0.44 (95% CI 0.15–0.72), $P = 0.004$. Pain (VAS) — difference between groups at 3 months +12.77 (0.26–25.28), $P = 0.046$. Quality of life (VAS 100 mm) at 3 months intergroup difference +17.97 (3.21–32.72), $P = 0.018$. Limitations: non-blind study due to the smell of sulfurous water and with limitations related to sample size.
10	M Karagulle et al 2016 [21]	Oxidative stress analysis revealed a significant increase in NSSA in the spa group ($p = 0.003$), with no changes in the control ($p = 0.509$). Compared with the control group, there was a trend towards improvement in NSSA in favor of balneotherapy ($p = 0.091$). Clinically, the spa group showed significant improvements compared to the control in patient global assessment ($p = 0.011$), physician assessment ($p = 0.043$), HAQ-DI functionality ($p = 0.037$), DAS28–4[ESR] disease activity ($p = 0.044$) and swollen joints ($p = 0.009$), as well as a trend towards pain reduction ($p = 0.057$). The results suggest beneficial antioxidant and clinical effects of salt water balneotherapy in RA.

*Legend: RA – rheumatoid arthritis, OA – osteoarthritis, HAQ – Health Assessment Questionnaire, BASFI – Bath Ankylosing Spondylitis Functional Index, VAS – visual analogue scale of fatigue, WSW – Warm Salt Water, WW – Warm Water, BRAF-MDQ – Bristol Rheumatoid Arthritis Fatigue Multidimensional Questionnaire, DAS-28 – Disease Activity Score, PSQI – Pittsburgh Sleep Quality Index, CPR – C-reactive protein, ESR – erythrocyte sedimentation rate, HAQ-DI – Health Assessment Questionnaire–Disability Index, NSSA – Nonenzymatic Superoxide Scavenger Activity

4. Discussion

Following the analysis of the studies co-opted in the paper, it was observed that there are two major benefits following the balneotherapy intervention: pain is significantly reduced [14, 16, 18, 20], and life capacity is improved [2, 16, 21]. Pain relief was evidenced both by a decrease in the VAS index [2] and by a reduction in the

consumption of analgesics [14]. The improvement in functional status is quantified by a reduction in the HAQ (Health Assessment Questionnaire) score, but also by a decrease in the overall disease activity score (DAS28) [2, 16, 17, 18, 20, 21]. The effects at the biochemical level revealed antioxidant and anti-inflammatory mechanisms. Post-therapy, an increase in the neutralization activity of superoxide radicals (NSSA) and a reduction in pro-inflammatory markers (IL-6, NO) were observed [13, 21]. Radon balneotherapy led to a reduction in the consumption of analgesic and anti-inflammatory drugs, a benefit observed in the long term [14].

The instruments of physical and rehabilitation medicine (PRM), which include kinetotherapy, electrotherapy, massage, hydrothermotherapy, occupational therapy and balneotherapy, have an important role in the management of RA [9, 10]. The main benefits are improvement of muscle strength, functional capacity, pain, morning stiffness [9, 22]. As an addition to the pharmacological treatment, all these non-pharmacological treatments sustain the QoL. The effects are not only on the musculoskeletal system, but also improves the function of other organs and systems affected in patients with RA [9, 10, 22]. Including all these instruments as adjuvants in the treatment of RA patients, induces a better control of inflammation and progression of the disease [9, 10, 22]. Most studies are focusing only on the use of physical exercises [10, 22], but all the factors included in the field of PRM, especially balneotherapy can be integrated in the non-pharmacological management of RA [9].

The results of the studies included in the analysis highlight that balneotherapy (mineral water baths, peloidotherapy, psamotherapy, etc.) can be used as an adjuvant treatment in the management of RA [18, 20]. Their integration into the therapeutic plan can help manage symptoms such as pain, fatigue and sleep disorders. The possibility of applying some of these procedures even at home (salt water baths) leads to better accessibility, but also to increased compliance with treatment [17]. Most patients included in the studies in the current analysis were under treatment with conventional DMARDs, the research results being directly applicable to this population. A large number of observational data collected from real clinical practice support the effectiveness of balneal treatment in a multitude of rheumatic and musculoskeletal conditions [15].

Conducting studies to establish the effects of balneotherapy is necessary, but also has limitations. The variety of balneological factors, as well as their composition, and the procedures for applying the interventions (duration of sessions, frequency, temperature) increase the difficulty of directly comparing studies, and this prevents the performance of robust meta-analyses. One of the main limitations of the analyzed studies is given by the small sample sizes, which limits the generalization of the obtained results [13, 16, 20]. Two of the studies included a heterogenous population, including patients with other pathologies, like OA, which limits the outcomes regarding the benefits of balneotherapy in patients with RA [14, 15]. Moreover, in studies in the field of balneotherapy there is an increased risk of bias, caused by the difficulty of performing double-blind studies, which can lead to placebo effects which may interfere with the results reported by patient and also the results reported by the observers [16, 21]. The duration of the interventions, but also the follow-up period, was short in most studies (weeks or months), which makes it impossible to issue clear conclusions regarding the sustainability of the long-term benefits [13]. The extended follow-up of patients led to an increased drop-out rate, which may have influenced the final results [19]. Another limitation is the study selection process. Despite the clear process described above, it is possible that some relevant studies were not included in the analysis due to lack of access to the full text, language barrier, or inappropriate time frame.

The results obtained regarding the short-term effects of balneotherapy on pain and functionality in patients with RA are largely consistent with the conclusions of other analyses in the literature. There are also differences, such as the influence on

biological markers of inflammation (ESR, CRP) which is not constant between studies, because even if a subjective clinical improvement was highlighted, the changes in these markers after treatment are not significant. Discrepancies have also been recorded in large observational studies. Although there are general benefits, in patients with RA the effects, such as pain relief, may not reach the threshold of statistical significance, unlike other conditions included in the study, such as chronic low back pain or osteoarthritis [15]. Given these inconsistencies, but also the limitations given by the study identification process or the quality of the study methodology, further studies are necessary, especially in terms of elucidating the mechanisms of action, but also identifying as accurately as possible the subgroups of patients who would have the greatest benefits from balneotherapy.

5. Conclusions

Based on the analysis of the existing evidence, balneotherapy is an intervention that can play an important role in the management of RA. This is supported by the significant clinical benefits in pain relief and functional improvement, observed in the short and medium term. Balneotherapy should be considered as an adjunctive treatment option and integrated into the management plan of the patient with RA.

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