

CONGRESSO INTERNACIONAL DE TERMALISMO



BALNEOLOGY EFFICACY: LITERATURE EVIDENCE AND CLINICAL EXPERIENCE



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*Objective

The aim of this study is to analyze the evidence of Balneology in several clinical conditions and to compare it with the efficacy observed in clinical practice.

*Material and Methods

- **Systematic review** of the published papers on the Balneology field in English, Portuguese, French, Spanish and Italian, until December 2018, on Medline, Embase, Cochrane Library, Web of Science and Scopus databases. We excluded Russian due to the fact that we were absolutely unable to understand or translate it.
- All systematic reviews, summaries of systematic reviews, meta-analysis and randomized control trials in Balneology was considered for further analysis.
- MeSH (Medical Subject Headings) terms / Key-words: “Balneology”, “Balneotherapy”, “Crenotherapy”, “Hydrotherapy”, “Spa Therapy”, “Water therapy”, “aquatic exercise”, “mineral waters”.
 - Notice that these terms in red are not really MeSH words. This underlines the relevance of using correct or the right lexicum once we found more relevant papers when introducing these vary terms as key-words.

*Material and Methods

Just to show the difference by a single example....

MeSH terms only

versus

MeSH terms + Key-words

19427 articles

86971 articles
(4,5x more articles)

*Results:

Flow chart illustrating the literature search and evaluation.

Potential relevant articles (86987)

Articles excluded by title and/or abstract (86599)

Full articles reviewed (371)

Articles not meeting inclusion criteria (58)

Articles included (134)

Musculoskeletal
(90)

. MA 8
. SR 23
. Summary SR 2
. RCT 57

Respiratory
(6)

. MA 2
. RCT 4

Vascular
(4)

Metabolic
(4)

Neuropsychiatry
(8)

Dermatolog
y (11)

Cardiac
(3)

Others
(8)

*Results:

Musculoskeletal conditions

Author	Title	Results
Meta-analysis		
Bender I, et al, 2014	Evidence-based hydro- and balneotherapy in Hungary-- a systematic review and meta-analysis.	Balneotherapy with Hungarian thermal-mineral waters is an effective remedy for <u>lower back pain</u> , as well as for <u>knee and hand osteoarthritis</u> .
Naumann J, et al, 2014	Therapeutic benefit of balneotherapy and hydrotherapy in the management of <u>fibromyalgia syndrome</u> : a qualitative systematic review and meta-analysis of randomized controlled trials.	High-quality studies with larger sample sizes are needed to confirm the therapeutic benefit of Balneotherapy, with focus on long-term results and maintenance of the beneficial effects.
Liu H et al, 2013	The effect of mud therapy on pain relief in patients with <u>knee osteoarthritis</u> : a meta-analysis of randomized controlled trials.	Mud therapy is a favourable option for pain relief in patients with knee OA.
Corbett MS et al, 2013	Acupuncture and other physical treatments for the relief of pain due to <u>osteoarthritis of the knee</u> : network meta-analysis.	Acupuncture and other physical treatments for the relief of pain due to osteoarthritis of the knee: network meta-analysis.
Nüesch E et al, 2013	Comparative efficacy of pharmacological and non-pharmacological interventions <u>in fibromyalgia</u> syndrome: network meta-analysis	The evidence for benefits of non-pharmacological interventions is limited.

*Results:

Musculoskeletal conditions

Author	Title	Results
Meta-analysis		
Langhorst J, et al, 2009	Efficacy of hydrotherapy in <u>fibromyalgia syndrome</u> --a meta-analysis of randomized controlled clinical trials.	There is moderate evidence that hydrotherapy has short-term beneficial effects on pain and HRQOL in FMS patients. There is a risk to over-estimate the effects of hydrotherapy due to methodological weaknesses of the studies and to small trials included in meta-analysis.
Pittler et al, 2006	Spa therapy and balneotherapy for treating <u>low back pain</u> : meta-analysis of randomized trials.	There is encouraging evidence suggesting thatspa therapy and balneotherapy may be effective for treating patients with low back pain.
Brosseau L, et al, 2002	Efficacy of balneotherapy for <u>rheumatoid arthritis</u> : a meta-analysis.	These modalities were found to be especially beneficial for pain, grip strength, tender/swollen joints, patient and physician, and global function. These improvements ranged from 5-93% greater improvement relative to the control group.

*Results:

Musculoskeletal conditions

Author	Title	Results
Summary of systematic reviews based on RCT		
Zão A, Cantista P. 2017	The role of land and aquatic exercise in ankylosing spondylitis: a systematic review.	Most studies showed a positive effect of exercise on Bath Ankylosing Spondylitis Disease Activity Index, Bath Ankylosing Spondylitis Functional Index, pain, mobility, function and quality of life.
Lauche R et al 2015	A Systematic Overview of Reviews for Complementary and Alternative Therapies in the Treatment of the Fibromyalgia Syndrome.	Consistently positive results were found for balneotherapy/hydrotherapy.
Kamioka H et al, 2010	Effectiveness of Aquatic Exercise and Balneotherapy: A Summary of Systematic Reviews Based on Randomized Controlled Trials of Water Immersion Therapies	Aquatic exercise had a small but statistically significant short-term effect on locomotor diseases. However, the effectiveness of balneotherapy in curing disease or improving health remains unclear.

*Results:

Musculoskeletal conditions

Author	Title	Results
Systematic reviews		
Forestier R et al, 2016	Spa therapy and knee osteoarthritis : A systematic review.	Improvements with spa therapy for knee OA appear to be clinically relevant until 3 to 6 months and sometimes 9 months.
Santos I, Cantista et al, 2016	Balneotherapy in rheumatoid arthritis —a systematic review	The conclusions are mostly in favour of balneotherapy; however, due to the large variability of methodologies and interventions, the results are still poor especially about RA.
Karagülle M et al, 2015	Effectiveness of balneotherapy and spa therapy for the treatment of chronic low back pain : a review on latest evidence.	The data from the RCTs indicates that overall evidence on effectiveness of balneotherapy and spa therapy in LBP is encouraging and reflects the consistency of previous evidence. However, the overall quality of trials is generally low.
Verhagen AP et al, 2015	Balneotherapy (or spa therapy) for rheumatoid arthritis .	Overall evidence is insufficient to show that balneotherapy is more effective than no treatment, that one type of bath is more effective than another or that one type of bath is more effective than mudpacks, exercise or relaxation therapy

*Results:

Musculoskeletal conditions

Author	Title	Results
Systematic reviews		
Verhagen AP et al, 2015	Balneotherapy (or spa therapy) for <u>rheumatoid arthritis</u> . An abridged version of Cochrane Systematic Review.	We were not able to assess any clinical relevant impact of balneotherapy over placebo, no treatment or other treatments.
Fraioli A, et al, 2013	Clinical researches on the efficacy of spa therapy in <u>fibromyalgia</u> . A systematic review.	Study data confirms that spa therapy could improve the symptoms of fibromyalgia including pain, depression and minor symptoms.
Espejo-Antúnez L et al, 2013	Clinical effectiveness of mud pack therapy in <u>knee osteoarthritis</u>	Mud pack therapy is considered an alternative and effective therapy in the clinical management of knee.
Terhorst L et al, 2011	Complementary and alternative medicine in the treatment of pain in <u>fibromyalgia</u> : a systematic review of randomized controlled trials.	Two CAM categories showed the most promising findings, balneotherapy and mind-body therapies.
Falagas et al, 2009	The therapeutic effect of balneotherapy: evaluation of the evidence from randomized controlled trials.	The available data suggest that balneotherapy may be truly associated with improvement in several rheumatological diseases (<u>osteoarthritis, fibromyalgia, ankylosing spondylitis, rheumatoid arthritis, chronic low back pain</u>)
Françon A, et al, 2009	Spa therapy in rheumatology . Indications based on the clinical guidelines of the French National Authority for health and the European League Against Rheumatism, and the results of 19 randomized clinical Trials	Spa therapy, or hot-water balneology, appears to be indicated for <u>chronic low back pain, stabilized rheumatoid arthritis, ankylosing spondylitis and fibromyalgia.</u>
Baranowsky J et al, 2009	Qualitative systemic review of randomized controlled trials on complementary and alternative medicine treatments in <u>fibromyalgia</u> .	Best evidence was found for balneotherapy / hydrotherapy in multiple studies

*Results:

Musculoskeletal conditions

Author	Title	Results
Systematic reviews		
Harzy T et al, 2009	Short- and long-term therapeutic effects of thermal mineral waters in <u>knee osteoarthritis</u> : a systematic review of randomized controlled trials.	All interventions that were used in these trials found out an improvement in pain and functional capacity, which were sustained until week 24
Forestier et al, 2008	Crenobalneotherapy for <u>limb osteoarthritis</u> : systematic literature review and methodological analysis.	Although the consistency of the results suggests a therapeutic effect of crenobalneotherapy in limb osteoarthritis, available studies are methodologically inadequate and sample sizes too small to allow definitive conclusions
McVeigh JG, et al, 2008	The effectiveness of hydrotherapy in the management of <u>fibromyalgia syndrome</u> : a systematic review.	Positive outcomes were reported for pain, health-status and tender point count. There is strong evidence for the use of hydrotherapy in the management of FMS.
Verhagen A, et al, 2008	Balneotherapy for <u>osteoarthritis</u> . A cochrane review.	We found silver-level evidence concerning the beneficial effects of mineral baths compared to no treatment. Of all other balneological treatments, no clear effects were found.
Verhagen A, et al, 2007	Balneotherapy for <u>osteoarthritis</u> .	We found silver level evidence concerning the beneficial effects of mineral baths compared to no treatment. Of all other balneological treatments no clear effects were found.
Karagülle MZ, et al, 2004	Balneotherapy and spa therapy of <u>rheumatic diseases</u> in Turkey: a systematic review	The review has shown the effectiveness of the investigated spa therapy and balneotherapy forms. It could be concluded that nearly all forms of spa therapy and balneotherapy used for the treatment of rheumatic diseases in Turkey are effective.

*Results:

Musculoskeletal conditions

Author	Title	Results
Systematic reviews		
Verhagen A, et al, 2003	Balneotherapy for <u>rheumatoid</u> arthritis.	One cannot ignore the positive findings reported in most trials. However the scientific evidence is insufficient because of the poor methodological quality.
Verhagen A, et al, 2000	Balneotherapy for <u>rheumatoid</u> arthritis and osteoarthritis.	One cannot ignore the positive findings reported in most trials. However the scientific evidence is insufficient because of the poor methodological quality.
Verhagen AP et al, 1997	Taking baths: the efficacy of balneotherapy in patients with <u>arthritis</u> . A systematic review.	Most studies report positive findings, but all studies showed methodological flaw

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Santos I, Cantista P, Vasconcelos C, Amado J. 2016	Balneotherapy and Rheumatoid Arthritis: A Randomized Control Trial.	In individuals in whom pain (physical and psychological) predominates, any complementary gain in function is beneficial.
Forestier R et al, 2014	Crenobalneotherapy (spa therapy) in patients with <u>knee and generalized osteoarthritis</u> : a post-hoc subgroup analysis of a large multicentre randomized trial.	Spa therapy with home exercises may be superior to home exercise alone in the management of patients with GOA associated with knee OA.
Fioravanti A et al, 2014	Short- and long-term effects of mud-bath treatment on <u>hand osteoarthritis</u> : a randomized clinical trial.	The results confirm that the beneficial effects of spa therapy in patients with hand OA last over time.
Kulisch Á, et al, 2014	Evaluation of the effect of Lake Hévíz thermal mineral water in patients with <u>osteoarthritis of the knee</u> : a randomized, controlled, single-blind, follow-up study.	Balneotherapy improved pain, function as well as the quality of life in patients with knee osteoarthritis.
Annegret F et al, 2013	Long-term benefits of radon spa <u>therapy in rheumatic diseases</u> : results of the randomized, multi-centre IMuRa trial.	Results suggest beneficial analgesic effects of radon spa therapy in rheumatic diseases until 9 months post-intervention.
Ciprian L, et al, 2013	The effects of combined spa therapy and rehabilitation on patients with <u>ankylosing spondylitis</u> being treated with TNF inhibitors.	Combined spa therapy and rehabilitation caused a clear, long-term clinical improvement in ankylosing spondylitis patients being treated with TNF inhibitors. Thermal treatment was found to be well tolerated and none of the patients had disease relapse.

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Espejo Antúnez L et al, 2013	Effects of mud therapy on perceived pain and quality of life related to health in patients with <u>knee osteoarthritis</u> .	Mud therapy in patients diagnosed with knee osteoarthritis attains immediate effects on perceived pain and HRQOL, reducing the consumption of specific drugs.
Dilek B, et al, 2013	Efficacy of paraffin bath therapy in <u>hand osteoarthritis</u> : a single-blinded randomized controlled trial.	Paraffin bath therapy seemed to be effective both in reducing pain and tenderness and maintaining muscle strength in hand osteoarthritis. It may be regarded as a beneficial short-term therapy option, which is effective for a 12-week period.
Kovacs C, et al., 2012	The effect of sulfurous water in patients with <u>osteoarthritis of the hand</u> . double-blind, randomized, controlled follow-up study	Balneotherapy and within this the sulfurous spa water alone may be effective for the attenuation of pain in patients with hand osteoarthrosis.
Horváth K, et al., 2012	Evaluation of the effect of balneotherapy in patients with <u>osteoarthritis of the hands</u> : a randomized controlled single blind follow-up study.	Balneotherapy combined with magnetotherapy improved the pain and function as well as the quality of life in patients with hand osteoarthritis.
Kesiktaş N, et al., 2012	Balneotherapy for <u>chronic low back pain</u> : a randomized, controlled study	Balneotherapy combined with exercise therapy had advantages over therapy with physical modalities plus exercise in improving quality of life and flexibility of patients with chronic low back pain
Tefner IK, et al., 2012	The effect of spa therapy in <u>chronic low back pain</u> : a randomized controlled, single blind, follow-up study	The study demonstrated - in comparison with treatment with tap water - the beneficial effect« of balneotherapy on clinical parameters in chronic low back pain. Additionally, it had a clearly positive impact on the patients quality of life, as well as on their analgesic and NSAID requirements.

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Fioravanti A, et al, 2012	Efficacy of balneotherapy on pain, function and quality of life in patients with <u>osteoarthritis of the knee</u>	results show the beneficial effects of a cycle of sulphate bicarbonate calcium mineral water baths on the pain management, functional capacity and quality of life parameters in patients with knee osteoarthritis. This therapy also proved to have long-lasting effects during the follow-up period (3 months). Our results confirm that balneotherapy may therefore be a useful aid, alongside the usual pharmacological and physio-kinesiotherapies, and may represent an alternative treatment in patients with osteoarthritis with a high risk of drug-related side effects.
Ozkurt S, et al., 2012	Balneotherapy in <u>fibromyalgia</u> : a single blind randomized controlled clinical study	Balneotherapy is found to be effective in treating patients with fibromyalgia. Beneficial effects are observed both in short and long terms. There is a need for further randomized controlled studies to verify these results and to identify whether balneotherapy is cost effective in fibromyalgia treatment.
Kesiktas N, et al, 2011	The efficacy of balneotherapy and physical modalities on the pulmonary system of patients with <u>fibromyalgia</u>	Balneotherapy is found to be effective in FMS patients' spirometric measurements and some symptoms. Beneficial effects are observed both at the end of therapy and six months follow-up.
Forestier R, et al., 2010	Spa therapy in the treatment of <u>knee osteoarthritis</u> : a large randomized multicentre trial	For patients with knee osteoarthritis a 3-week course of spa therapy together with home exercise and usual pharmacological treatments offers benefit after 6 months compared with exercise and usual treatment alone, and is well tolerated.
Fioravanti A, et al., 2010	Short- and long-term effects of spa therapy in <u>knee osteoarthritis</u>	The beneficial effects of spa therapy in patients with knee osteoarthritis lasts over time, with positive effects on the painful symptomatology and a significant improvement on functional capacities. Spa therapy can represent a useful backup to pharmacologic treatment of knee osteoarthritis or a valid alternative for patients who do not tolerate pharmacologic treatments.

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Langhorst J, et al, 2009	Efficacy of hydrotherapy in <u>fibromyalgia</u> syndrome--a meta-analysis of randomized controlled clinical trials.	There is moderate evidence that hydrotherapy has short-term beneficial effects on pain and HRQOL in FMS patients.
Kulisch A, et al, 2009	Effect of thermal water and adjunctive electrotherapy on <u>chronic low back pain</u> : a double-blind, randomized, follow-up study.	In the group treated with thermal water, improvement occurred earlier, lasted longer and was statistically significant.
Sherman G, et al, 2009	Intermittent Balneotherapy at the Dead Sea area for patients with <u>knee osteoarthritis</u>	Intermittent balneotherapy appears to be effective for patients with knee osteoarthritis.
Karagülle M, et al., 2008	A 10-day course of SPA therapy is beneficial for people with severe <u>knee osteoarthritis</u> . A 24-week randomized, controlled pilot study	A 10-day traditional spa therapy may have a role in the management of severe knee osteoarthritis (OA) and might be an effective alternative to drug therapy in countries, like Turkey, where it is affordable and widely used by patients and is partly reimbursed by health insurance systems as well.
Leibetseder V, et al, 2007	Does aerobic training enhance effects of spa therapy in <u>back pain</u> patients? A randomized, controlled clinical trial	Individualized aerobic training does not seem to enhance beneficial effects of a 3-week spa therapy on chronic pain and quality of life.
Franke A, et al, 2007	Long-term benefit of radon spa therapy in the rehabilitation of <u>rheumatoid arthritis</u> : a randomized, double-blinded trial	Beneficial long-term effects of radon baths as adjunct to a multimodal rehabilitative treatment of RA.
Forestier R, et al., 2007	Are SPA therapy and pulsed electromagnetic field therapy effective for <u>chronic neck pain</u> ? Randomized clinical trial first part: clinical evaluation	PEMF seems to be superior to standard ST without massage in control of neck pain. The difference between groups, although perhaps biased, seems to suggest

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Forestier R, et al., 2007	Are SPA therapy and pulsed electromagnetic field therapy effective for <u>chronic neck pain</u> ? Randomized clinical trial. Second part: medicoeconomic approach	A potential cost-effectiveness for ST and particularly PEMF as compared to usual care in chronic cervical pain. Our results perhaps lack significance probably because of lack of statistical power and do not distinguish sodts [What does the term “sodts” mean?] related or not to chronic cervical pain.
Fioravanti A, et al, 2007	Effects of mud-bath treatment on <u>fibromyalgia</u> patients: a randomized clinical trial.	Our results suggest the efficacy and the tolerability of mud-bath treatment in primary FS.
Cantarini L, et al., 2007	Therapeutic effect of spa therapy and short wave therapy in <u>knee osteoarthritis</u> : a randomized, single blind, controlled trial	The superiority of arsenical-ferruginous spa therapy compared to short wave therapy, and it confirmed the symptomatic efficacy of spa therapy, already shown by other authors, in the treatment of gonarthrosis.
Cozzi F, et al, 2007	Mud-bath treatment in <u>spondylitis</u> associated with inflammatory bowel disease –a pilot randomized clinical trial.	Mud-bath treatment in patients with spondylitis associated with inflammatory bowel disease is well tolerated and may improve spinal symptoms and function for several months.
Ardıç F, et al., 2007	Effects of balneotherapy on serum IL-1, PGE2 and LTB4 levels in <u>fibromyalgia</u> patients	Balneotherapy is an effective choice of treatment in patients with FMS relieving the clinical symptoms, and possibly influencing the inflammatory mediators.
Zijlstra T et al, 2007	Cost-effectiveness of Spa treatment for <u>fibromyalgia</u> : general health improvement is not for free	The temporary improvement in quality of life due to an adjuvant treatment course of spa therapy for patients with FM is associated with limited incremental costs per patient.

*Results:

Musculoskeletal conditions

Author	Title	Results
Randomized controlled trials		
Yurtkuran M, et al., 2006	Balneotherapy and tap water therapy in the treatment of <u>knee osteoarthritis</u>	The results of our placebo-controlled study including the assessment of the clinical-physical functions and quality of life have led us to suggest that BT may be more effective immediately after treatment and in the long-term than heated TW in reducing only pain and tenderness in KOA patients. The changes in the physical function, quality of life, and other clinical variables were similar. These results may stimulate further research with longer follow-up period and larger patient groups.
Balint GP, et al., 2006	The effect of the thermal mineral water of Nagybaracska on patients with <u>knee joint osteoarthritis</u> - a double-blind study	Thermal mineral water provides significant pain relief in nonsurgical osteoarthritis of the knee, and this was greater than that of tap water at the same temperature.
Altan L, et al., 2006	The effect of balneotherapy on patients with <u>ankylosing spondylitis</u>	Balneotherapy has a supplementary effect on improvement in disease activity and functional parameters in ankylosing spondylitis patients immediately after the treatment period. However, in the light of our medium-term evaluation results, we suggest that further research is needed to assess the role of balneotherapy applied for longer durations in ankylosing spondylitis Patients
Donmez A, et al., 2005	Spa therapy in <u>fibromyalgia</u> : a randomized controlled clinic study	Spa therapy is found to be effective in Fibromyalgia patients. Beneficial effects are observed both in the short and the long-term. There is a need for further randomized and controlled studies to verify these results, and to identify whether spa therapy is cost effective in Fibromyalgia.
Balogh Z, et al., 2005	Effectiveness of balneotherapy in <u>chronic low back pain</u> : a randomized single-blind controlled follow-up study	Balneotherapy in itself can alleviate low back pain. As demonstrated by this study, the analgesic efficacy and improvement of mobility accomplished by the use of mineral water is significantly superior to that afforded by hydrotherapy with tap water. Our results clearly establish the beneficial effects of mineral water. Moreover, it is a valuable adjunct to other forms of physical treatment as well as to pharmacotherapy.

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Codish S, et al., 2005	Spa therapy for <u>ankylosing spondylitis</u> at the Dead sea	Climatotherapy at the Dead Sea area can improve the condition of patients suffering from long-standing ankylosing Spondylitis.
Codish S, et al., 2005	Mud compression therapy for the hands of patients with <u>rheumatoid arthritis</u>	Treatment with mud compresses relieves pain affecting the hands and reduces the number of swollen and tender joints in the hands of patients suffering from RA. This treatment can augment conventional medical therapy in these patients.
Yurtkuran M, et al., 2005	Improvement of the clinical outcome in <u>ankylosing spondylitis</u> by balneotherapy	We concluded that balneotherapy and balneotherapy þ nonsteroid antiinflammatory drug use can be suggested as an effective symptomatic treatment modality in patients with ankylosing spondylitis. Furthermore, sufficient improvement in clinical parameters can be obtained by balneotherapy þ nonsteroid antiinflammatory drug use and balneotherapy alone.
Kovacs I, et al., 2002	The therapeutic effects of thermal water in <u>osteoarthritis of the knee</u> : a double-blind, controlled, follow-up study	Balneotherapy has the potential to become a major nonpharmacologic modality in the therapy of musculoskeletal disease.
Ekmekcioglu C, et al., 2002	Effect of sulfur baths on antioxidative defense systems, peroxide concentrations and lipid levels in patients with <u>degenerative osteoarthritis</u>	A sulfur bath therapy could cause a reduction in oxidative stress, alterations of superoxide dismutase (SOD) activities, and a tendency towards improvement of lipid levels.
Tubergen AV, et al., 2002	Cost-effectiveness of combined spa-exercise therapy in <u>ankylosing spondylitis</u> : a randomized controlled trial	Combined spa-exercise therapy besides standard treatment with drugs and weekly group physical therapy is more effective and shows favorable cost-effectiveness and cost-utility ratios compared with standard treatment alone in patients with AS.

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Bellometti S, et al, 2002	Both serum receptors of tumor necrosis factor are influenced by mud pack treatment in <u>osteoarthrotic</u> patients	Our results suggest that the thermic component of this natural treatment is mainly involved in modulating inflammatory reaction and cartilage damage through binding of the circulating TNF, which controls the activation of the cells responsible for the production of proinflammatory cytokines.
Buskila D, et al., 2001	Balneotherapy for <u>fibromyalgia</u> at the Dead sea	Treatment of fibromyalgia at the Dead Sea is effective and safe and may become an additional therapeutic modality in fibromyalgia.
Neumann L, et al., 2001	The effect of balneotherapy at the Dead Sea on the quality of life of patients with <u>fibromyalgia</u> syndrome	Staying at a Dead Sea spa, and especially the addition of balneotherapy, can transiently improve the QoL of patients with Fibromyalgia. Other controlled studies, with longer follow-up periods, are needed to strengthen our findings
Van Tubergen AV, et al., 2001	Combined spa-exercise therapy is effective in patients with <u>ankylosing spondylitis</u> : a randomized controlled tri	In patients with AS, a 3-week course of combined spa-exercise therapy, in addition to drug treatment and weekly group physical therapy alone, provides beneficial effects. These beneficial effects may last for at least 40 weeks.
Franke A, et al., 2001	Long-term efficacy of radon spa therapy in <u>rheumatoid arthritis</u> -a randomized, <u>sham-controlled</u> study and follow-up	Marked short-term improvements in both groups at the end of treatment may have masked potential specific therapeutic effects of radon baths. However, after 6 months of follow-up the effects were lasting only in patients of the radon arm. This suggests that this component of the rehabilitative intervention can induce beneficial long-term effects.
Guillemin F, et al, 2001	Effects on <u>osteoarthritis</u> of spa therapy at Bourbonne-les-Bains.	Patients report meaningful improvements in their quality of life after spa therapy.
Sukenik S, et al, 1999	Balneotherapy at the Dead Sea area for <u>knee osteoarthritis</u> .	Balneotherapy at the Dead Sea area has a beneficial effect on patients withosteoarthritis of the knees, an effect that last at least 3 months.

*Results:

Musculoskeletal conditions

Author	Title	Results
randomized controlled trials		
Constant F, et al., 1998	Use of spa therapy to improve the quality of life of <u>chronic low back pain</u> patients	Spa therapy is an effective treatment for chronic low back pain patients
Nguyen M, et al., 1997	Prolonged effects of 3-week therapy in a spa resort on <u>lumbar spine, knee and hip osteoarthritis</u> : following-up after 6 months. A randomized controlled trial	Spa therapy of 3 weeks duration has a prolonged, beneficial, symptomatic effect in osteoarthritis.
Sukenik S, et al., 1995	Balneotherapy for <u>rheumatoid arthritis</u> at the Dead Sea	Bathing in Dead Sea water and sulfur baths, alone or in combination, is safe and effective, for up to 3 months, in the treatment of active RA
Wifler I, et al., 1995	Spa therapy for <u>gonarthrosis</u> : a prospective study	Mud packs and mineral baths are safe and effective for the short- and medium-term treatment of osteoarthritis (OA) of the knee. The beneficial effect is in part due to rest and local heat, but it seems that balneotherapy in itself has a positive effect on OA patients.
Constant F, et al., 1995	Effectiveness of spa therapy in chronic <u>low back pain</u> : a randomized clinical trial	Both immediate and 6-month effectiveness of spa therapy in chronic LBP. Spa therapy may be beneficial in the management of chronic LBP
Guillemin F, et al., 1994	Short and long-term effect of spa therapy in chronic <u>low back pain</u>	Spa therapy has a positive short-term and a moderate long-term effectiveness on chronic LBP.
Elkayam O, et al., 1991	Effect of spa therapy in Tiberias on patients with <u>rheumatoid arthritis and osteoarthritis</u>	Mud packs and mineral baths are relatively safe and could be partially beneficial in the treatment of RA
Sukenik S, 1990	Dead Sea salt baths for the treatment of <u>rheumatoid arthritis</u> .	A statistically significant improvement was observed in Group I (Dead Sea bath salts) only, in most of the clinical parameters assessed. Maximal therapeutic effect was obtained at the end of the treatment and lasted up to one month.

*Results:

Respiratory (ENT, COPD)

Author	Title	Results
Meta-analysis		
Keller S et al, 2014	Thermal water applications in the treatment of <u>upper respiratory tract diseases</u> : a systematic review and meta-analysis.	Thermal water applications with radon or sulphur can be recommended as additional nonpharmacological treatment in upper airway diseases. Also in comparison to isotonic saline solution it shows significant improvements and should be investigated further.

Author	Title	Results
randomized controlled trials		
Kunbootsri N, et al, 2013	The effect of six-weeks of sauna on treatment autonomic nervous system, peak nasal inspiratory flow and lung functions of <u>allergic rhinitis</u> Thai patients.	The six weeks of repeated sauna treatment can increase sympathetic activity, PNIF, and FEV1 in Thai patients with allergic rhinitis.
Ottaviano G, et al., 2012	<u>Smoking and chronic rhinitis</u> : effects of nasal irrigations with sulfurous-arsenical-ferruginous thermal water. A prospective, randomized, double-blind study	Our results indicate that nasal irrigations with thermal water had a good effect on endoscopic objective signs, nasal resistances, and epithelial trophism.
Miraglia Del Giudice M, et al., 2011	Effectiveness of Ischia thermal water nasal aerosol in children with seasonal <u>allergic rhinitis</u> : a randomized and controlled study	This study shows that nasal crenotherapy with the hypermineral chloride-sodium water of Ischia was effective in children with seasonal allergic rhinitis based on the sensitivity to Parietaria. These results demonstrate that this natural treatment may be effective in a common and debilitating disease such as the allergic rhinitis.
Ottaviano G, et al., 2011	Effects of sulfurous, salty, bromic, iodine thermal water nasal irrigations in nonallergic chronic <u>rhinosinusitis</u> : a prospective, randomized, double-blind, clinical, and cytological study	Both types of nasal irrigation improved the endoscopic and microbiological features of patients with nonallergic chronic rhinosinusitis, whereas only SSBI irrigations significantly reduced total nasal resistance.

*Results:

Vascular diseases

Authors	Title	Results
randomized controlled trials		
Forestier RJ et al, 2014	Balneohydrotherapy in the treatment of <u>chronic venous insufficiency</u> .	Balneohydrotherapy seems to improve quality of life of patients with chronic venous insufficiency.
Carpentier PH, et al., 2014	A multicenter randomized controlled trial evaluating balneotherapy in patients with advanced <u>chronic venous insufficiency</u> .	The incidence of leg ulcers was not reduced after a 3-week spa therapy course. Nevertheless, our study demonstrates that spa therapy provides a significant and substantial improvement in clinical status, symptoms, and quality of life of patients with advanced venous insufficiency for at least 1 year.
Carpentier PH, et al., 2009	<u>Randomized</u> trial of balneotherapy associated with patient education in patients with advanced <u>chronic venous insufficiency</u>	Spa therapy, associating balneotherapy and patient education, is able to improve significantly the skin trophic changes of the CVD patients and their CVD related quality of life and symptoms. This effect is of large magnitude and remains significant one-year after the treatment course.
Mancini S et al, 2003	Clinical, functional and quality of life changes after balneokinesis with sulphurous water in patients with <u>varicose veins</u> .	These results show additional benefits of balneokinetic treatment in patients with symptomatic varices submitted to elastic compression. In fact, clinical and quality of life improvements were observed. The associated amelioration in the veno-arteriolar reflex may support these subjective benefits.

*Results:

Metabolic conditions

Authors	Title	Results
randomized controlled trials		
Winklmayr M, et al, 2015	Radon balneotherapy and physical activity for osteoporosis prevention : a randomized, placebo-controlled intervention study.	A combined hyperthermia balneo and exercise treatment has significant immediate and long-term effects on regulators of bone metabolism as well as somatic complaints.
Loi A, et al, 2013	Bone mineral density in women on long-term mud-bath therapy in a Salus per Aquam (SPA) environment.	Long-term mud-bath therapy in SPA environment appeared to be beneficial for BMD.
Hanh T, et al, 2012	One-year effectiveness of a 3-week balneotherapy program for the treatment of overweight or obesity.	A 3-week BT program provided a significant one-year benefit over the usual GP dietary advice for overweight and obese patients.
Wynn E, et al., 2009	Alkaline mineral water lowers bone resorption even in calcium sufficiency: alkaline mineral water and bone metabolism	In calcium sufficiency, the acid calcium-rich water had no effect on bone resorption, while the alkaline water rich in bicarbonate led to a significant decrease of PTH and of S-CTX.

*Results:

Neuropsychiatric conditions :

Authors	Title	Results
randomized controlled trials		
Rapolienè L, et al, 2016	<u>Stress and Fatigue</u> Management Using Balneotherapy in a Short-Time Randomized Controlled Trial	Balneotherapy is beneficial for stress and fatigue reduction in comparison with music or no therapy group. Geothermal water baths have a potential as an efficient approach to diminish stress caused by working or living conditions.
Kanji G, et al, 2015	Efficacy of regular sauna bathing for <u>chronic tension-type headache</u> : a randomized controlled study.	Regular sauna bathing is a simple, self-directed treatment that is effective for reducing headache pain intensity in CTTH.
Matzer F, et al, 2014	<u>Stress-relieving</u> effects of short-term balneotherapy - a randomized controlled pilot study in healthy adults.	Findings suggest that compared to PMR and resting, balneotherapy seems to be more beneficial with regard to subjective relaxation effects and similarly beneficial with regard to a decrease in salivary cortisol.
Dubois O, et al., 2010	Balneotherapy versus paroxetine in the treatment of <u>generalized anxiety disorder</u>	Balneotherapy (at least for the predominantly female population included in our study) appears to be an effective and well tolerated alternative for subjects with GAD who otherwise mainly rely on psychotropic drugs.
Volpe D, et al, 2014	Comparing the effects of hydrotherapy and land-based therapy on balance in patients with <u>Parkinson's disease</u> : a randomized controlled pilot study.	Our study suggests that hydrotherapy may constitute a possible treatment for balance dysfunction in Parkinsonian patients with moderate stage of disease.
Vivas J, et al, 2011	Aquatic therapy versus conventional land-based therapy for <u>Parkinson's disease</u> : an open-label pilot study.	Physiotherapy protocols produced improvement in postural stability in PD that was significantly larger after aquatic therapy. The intervention protocols are shown to be feasible and seem to be of value in amelioration of postural stability-related impairments in PD.
Brefel-Courbon C, et al., 2003	Clinical and economic analysis of spa therapy in <u>Parkinson's disease</u>	Spa therapy is more effective and less expensive than conventional treatment alone and could be beneficial in the management of PD.

*Results:

Dermatology :

Authors	Title	Results
randomized controlled trials		
Wong SM, et al, 2013	Efficacy and safety of sodium hypochlorite (bleach) baths in patients with moderate to severe atopic dermatitis in Malaysia.	This study demonstrates that diluted bleach baths clinically improved severe atopic dermatitis in as little as 1 month. No patient withdrew from the treatment arm because of intolerance to the baths.
Farina S, et al., 2011	Balneotherapy for atopic dermatitis in children at Comano spa in Trentino, Italy	Balneotherapy at Comano spa appears to be beneficial in children with mild to moderate AD.
Schiener R, et al., 2007	Bath PUVA and saltwater baths followed by UV-B phototherapy as treatments for psoriasis : a randomized controlled trial	Bath PUVA and SW UV-B are comparably effective treatments in psoriasis and superior to UV-B and TW UV-B.
Brockow T, et al, 2007	A pragmatic randomized controlled trial on the effectiveness of highly concentrated saline spa water baths followed by UVB compared to UVB only in moderate to severe psoriasis .	The study indicates that highly concentrated saline spa water baths followed by UVB are superior to routine UVB at the end of a 6-week treatment course.
Brockow T, et al, 2007	A pragmatic randomized controlled trial on the effectiveness of low concentrated saline spa water baths followed by ultraviolet B (UVB) compared to UVB only in moderate to severe psoriasis .	In routine clinical practice balneophototherapy using conventional UVB is superior to conventional UVB only at the end of a 6-week treatment course.
Delfmo M, et al., 2003	Studio sperimentale sull'efficacia dei fanghi termali dell'isola di Ischia associati a balneoterapia nella cura della psoriasi volgare a placchea	Results obtained can be considered useful, considering that thermal treatment was used alone in the treatment of all patients.
Gambichler T, et al., 2001	Balneophototherapy of psoriasis : highly concentrated saltwater versus tap water e a randomized, one-blind, right/left comparative study	Our results suggest that any additional benefit of soaking in salt water and tap water in BPT are unlikely to be due to the salinity of the liquids.
Sukenik S et al, 1994	Treatment of psoriatic arthritis at the Dead Sea.	Treatment of psoriasis and PsA at the Dead Sea area is very efficacious and the addition of balneotherapy can have additional beneficial effects on patients with PsA

*Results:

Cardiovascular

Authors	Title	Results
randomized controlled trials		
Olah M, et al., 2011	The effect of balneotherapy on antioxidant, inflammatory, and metabolic indices in patients with <u>cardiovascular risk factors</u> (hypertension and obesity) da randomized, controlled, follow-up study	This study contributes important information regarding the safety of balneotherapy in hypertensive and obese diabetics by showing no alterations of antioxidant, inflammatory, or metabolic indices. The findings of this study confirm that balneotherapy is not contraindicated for hypertensive or obese patients.
Basford JR, et al, 2009	Safety, acceptance, and physiologic effects of sauna bathing in people with <u>chronic heart failure</u> : a pilot report.	Sauna bathing under the moderate and supervised conditions of this study appears to be well tolerated and may be safe for people with CHF.
Kihara T, et al, 2004	Effects of repeated sauna treatment on <u>ventricular arrhythmias</u> in patients with chronic heart failure	Repeated sauna treatment improves ventricular arrhythmias in patients with CHF.

*Results:

Other conditions

Authors	Title	Results
Systematic reviews		
Lang DS et al, 2011	Effectiveness of the Sitz bath in managing adult patients with <u>anorectal disorders</u> .	There was no strong evidence to support the use of the Sitz bath for pain relief and to accelerate fissure or wound healing among adult patients with anorectal disorders. However, the Sitz bath may be prescribed for patients' satisfaction.
Ernst E et al, 1998	How effective is spa treatment? A systematic review of randomized studies	The data are not sufficient to prove the benefit of spa treatment, nor are they adequate to disprove it.

*Results:

Authors	Title	Results
Randomized controlled trials		
Qiu Y, et al, 2014	Spa adjuvant therapy improves <u>diabetic lower extremity arterial disease</u> .	Spa adjuvant therapy can significantly alleviate lower extremity pain, numbness, and cold sensory symptoms in diabetic LEAD patients with stenosis. Moreover, in LEAD patients with mild stenosis, spa adjuvant therapy also improves the dorsalis pedis pulse and systolic peak velocity ratio, suggesting a potential role for spa therapy as an early intervention strategy to treat the initial stages of disease.
Mourgues C et al, 2014	Positive and cost-effectiveness effect of spa therapy on the resumption of occupational and non-occupational activities in women in <u>breast cancer</u> remission: a French multicentre randomized controlled trial.	Spa treatment is a cost-effective strategy to improve resumption of occupational and non-occupational activities and the abilities of women in breast cancer remission.
Kwiatowski F et al, 2013	Long term improved quality of life by a 2-week group physical and educational intervention shortly after breast cancer chemotherapy completion. Results of the 'Programme of Accompanying women after <u>breast Cancer</u> treatment completion in Thermal resorts' (PACThe) randomized clinical trial of 251 patients	This 2-week group intervention seemed to durably influence QoL of breast cancer patients treated by chemotherapy. Differences, smaller at 12 months than at six, suggest that a second but shorter intervention could help maintain the 6-month benefits.

*Results:

Authors	Title	Results
Randomized controlled trials		
Zambo L, et al., 2008	The efficacy of alum-containing ferrous thermal water in the management of <u>chronic inflammatory gynaecological disorders</u> -a randomized controlled study	As demonstrated by our results, 3-week balneotherapy is a potentially useful adjunct for the management of chronic pelvic inflammatory disease, but further, long-term studies are notwithstanding necessary.
Odabasi E et al 2008	Does mud pack treatment have any <u>chemical</u> effect? A randomized controlled clinical study.	Mud pack treatment significantly improved the pain and functional status of patients with knee osteoarthritis, whether applied directly or coated with nylon. Direct application was found to be superior, which implies chemical properties of the mud contribute to the build up of therapeutic effect.
Leibetseder V, et al., 2004	Improving <u>homocysteine</u> levels through balneotherapy: effects of sulfur baths	Sulfur baths exert beneficial effects on plasma tHcyt whereas effects on 8-OHdG seem to be unlikely.

*Results:

Disorders

Musculoskel (90)	Respiratory . MA 1 . RCT 4	Vascul (4)	Metabol (4)	Neuropsychi (7)	Dematol (8)	Cardiac (3)	Others (7)
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Musculoskeletal disorders	Meta-analysis	Summary of SR	Syst reviews (SR)	RCT
Osteoarthritis	3	1	9	32
Knee	2	1	9	28
Hand	1			4
Low back pain	2	1	3	11
Neck pain				2
Shoulder pain				1
Fibromyalgia	2	1	6	9
Rheumatic inflammatory diseases	1		8	13
Rheumatoid arthritis			4	8
Ankylosing spondylitis				

*Results:

- The majority of these studies shown significant clinical and functional benefit of balneology, corroborating the clinical experience.
- The number of articles regarding each type of pathologies is proportional to the number of patients with those pathologies treated using balneotherapy.

*Discussion

- The evidence regarding the benefits of Balneotherapy on these diseases (such as low back pain, fibromyalgia, osteoarthritis) is strong.
- Studying the effects of Balneology under double blind conditions is extremely difficult. Even so, the amount of studies is high, namely concerning musculoskeletal conditions.
- * The huge difference between the amounts of studies found using only MeSH versus the amounts considering other similar key-words, underlines the relevance of using the right *lexicum* and the appropriated terms, such as the defined MeSH words.
- * Thus, when submitting an article it can be easily accessed in databases.

*Discussion

- * We did not include non-randomized controlled clinical trials, which could increase the scope of this review and we admit this may have excluded potentially relevant articles.
- * However, concerning the lower methodologic quality of those non-randomized studies, we believe its exclusion reduced the risk of bias.
- * We performed a **qualitative review** since conducting meta-analysis was limited by the heterogeneity of study designs, participants, interventions and outcome assessment measures.

*Conclusion

Balneology - Evidence of benefit:

- Musculoskeletal disorders: Knee and hip osteoarthritis, fibromyalgia, chronic low back pain, ankylosing spondylitis, rheumatoid arthritis.
- Respiratory tract pathology
- Vascular disorders: venous insufficiency
- Neuropsychiatric disorders: generalized anxiety disorder, stress
- Dermat: psoriasis, atopic dermatitis
- Metabolic: osteoporosis, overweight

*Conclusion

- The efficacy observed on clinical practice, mainly reported by medical doctors working at Thermal Spas, is corroborated by the strong evidence of the literature.

Balneotherapy should be considered a **relevant therapy modality** in several conditions, namely musculoskeletal disorders and should be included as part of the treatment program.

*Conclusion

Further investigations into the effects of Balneology on the quality of life of patients and on health care costs are indispensable.

For those who have relevant papers not included in Pubmed, please try to rewrite the scientific words according to existing Databases terms.

*Conclusion

So...

For those who claim that there is a lack of evidence concerning Balneology, we reply with this presentation data.

The problem might be not the absence of scientific trials but the inefficacy of its communication.