

# Phytothermotherapy in osteoarthritis: new evidence for an old therapy

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**Introduction:** Osteoarthritis (OA) is the most common disabling joint disease worldwide. Moreover, its incidence and prevalence are increasing because of aging, higher life expectancy, and lifestyle changes, leading to a growing population of patients with OA. Current treatment of OA includes nonpharmacologic and pharmacologic modalities. Phytothermotherapy (PTT) is a singular crenotherapeutic treatment consisting of immersing oneself in pools of fermenting alpine grass, to exploit its heat and rich, aromatic components. The efficacy of PTT in OA is bolstered by ancient tradition. However, there is a marked lack of clinical validation of its efficacy and tolerability in current literature. The aim of this review was to evaluate the currently available knowledge of possible clinical effects and mechanisms of action of PTT in OA.

**Methodology:** We searched PubMed and Scopus (the period examined was 1980–2012) for clinical trials examining the effect of PTT in OA. MEDLINE was searched using the term “phytothermotherapy” and “hay baths” in combination with “osteoarthritis.” We included only papers published in English or Italian and in peer-reviewed journals.

**Results:** We identified three trials describing the results of PTT in OA. The available data demonstrate that PTT is efficacious in decreasing pain and disability and improving function in patients with OA. Moreover, the tolerability of PTT is excellent. The mechanisms of action of PTT are not yet completely known, although it is probably due to different combined mechanical, physical, and chemical effects.

**Discussion:** PTT could represent a useful aid in the treatment of OA or a valid alternative for patients who do not tolerate pharmacologic treatments. However, further studies on a larger number of patients are needed to provide more precise therapeutic guidelines on the modalities of use of PTT. Additionally, there is a need for other botanical investigations and research on the mechanisms of action of PTT.

**Keywords:** phytothermotherapy, osteoarthritis, fresh grass, fermenting grass

## Introduction

Osteoarthritis (OA) is the most common disabling joint disease worldwide. Moreover, its incidence and prevalence are increasing because of aging, higher life expectancy, and lifestyle changes, leading to a growing population of patients with OA.<sup>1,2</sup> Structural damage of the articular cartilage constitutes a hallmark of OA, resulting from an increased imbalance of cartilage degradation and synthesis.<sup>3</sup> Current treatment of OA includes nonpharmacologic and pharmacologic modalities.<sup>4,5</sup> Nonpharmacologic therapies include exercise, manual therapy, weight reduction, instructions in joint protection techniques, provision of assistive devices and insoles, thermal therapy, and use of joint splints.<sup>4,5</sup> Pharmacologic therapy has been largely confined to analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs), or selective cyclooxygenase-2

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(COX 2) inhibitors (COXibs). However, the use of NSAIDs is associated with well-known gastrointestinal and (less frequently) renal side effects<sup>6,7</sup> and is limited by their negative side effects on cartilage metabolism.<sup>8–10</sup> On the other hand, the use of COXibs is characterized by an increase in cardiovascular side effects.<sup>11,12</sup> Acetaminophen is better tolerated compared with NSAIDs and COXibs but does not always provide adequate pain relief.<sup>13,14</sup> These reasons often lead to the use of other, complementary or alternative therapies.<sup>15</sup>

Phytothermotherapy (PTT) is a singular crenotherapeutic treatment consisting of immersing oneself in pools of fermenting alpine grass, to exploit its heat and rich, aromatic components. The traditional expression “hay baths,” corresponding to the German “heybaeder,” is actually inappropriate, because in reality for PTT only fresh grass or frozen grass to avoid desiccation is used. The traditional name, although substantially incorrect, undoubtedly derives from the fact that this procedure was originally linked to haymaking practices. The expressions “grass baths” or more simply “phytothermotherapy” thus seem more accurate.<sup>16</sup> Bathing in fermenting mountain grass for alleviation of “joint pain” is a rather ancient practice traditionally carried out in some areas of northeast Italy and Austria. Various sources report that even at the beginning of the 19th century, peasants from some areas of those regions spent a whole day in haymaking, and then during the evening used to lie down on a bed of freshly cut grass. They woke up in the morning feeling perfectly refreshed and in great shape.<sup>17</sup> Throughout the second half of the 19th century, this popular practice gradually begun to assume the features of an accepted medical practice. In 1871, Dr Lersch<sup>18</sup> from Aachen, Germany, in one of his writings on PTT, observed that “grass baths” were used not only by peasants but also by all people suffering from “joint pain.” Actually, PTT is studied and used for treating many rheumatic diseases (RDs), especially in the area of Monte Bondone, a mountain above Trento (Italy).

The main indications for this method include OA and other degenerative joint diseases, extra-articular rheumatisms, both generalized, such as fibromyalgia syndrome, and localized forms.<sup>16,19</sup> The efficacy of PTT in OA is bolstered by ancient tradition. However, despite its long history and popularity, there is a marked lack of clinical validation of its efficacy and tolerability in current literature. In an era of evidence-based medicine, it is necessary to ask what real medical and scientific value this therapy has. The aim of this review is to evaluate the currently available information on possible clinical effects and mechanisms of action

of PTT in OA. We also provide some suggestions for further development in this area.

## The method of phytothermotherapy

The herbs used for PTT come from mountain meadows that are situated at altitudes between 1,200 and 1,500 m. This particular altitude represents a strategy because not only does it guarantee a peculiar floral mix but also it avoids insects and other parasites, which are practically nonexistent over 1,200 meters above sea level. The grass is a special composite blend of different herbs, encompassing woundwort, *Arnica montana* (European arnica, mountain tobacco, leopard's bane), *Achillea millefolium* (yarrow), *Alchemilla vulgaris* (bear's foot, ladies mantle), *Plantago media* (plantain), *Thymus serpyllum* (thyme), *Taraxacum alpinum* (blow ball, lion's tooth), *Vaccinium myrtillus* (blueberry), and *Gentiana lutea* (gentian).<sup>20</sup>

The grass is mowed, collected, and transported down to the valley and is then placed in 50 cm thick vats, where, left to ferment, it develops heat due to its own metabolic activity as well as that of the associated microbial flora. After 1–2 days, the deeper layers reach temperatures of 60°C or more, which are maintained throughout the whole thermal treatment.

The patient immerses him or herself in the warm bath and is covered with a 10–20 cm thick layer of grass every day for 20 minutes. After each bath, the patient lies on a reaction couch, wrapped in a woolen blanket, for 30–45 minutes. The reaction is characterized by profuse sweating, which gradually diminishes in 3–4 hours. A complete cycle of PTT lasts 10 days, with a 1-day interval halfway through the cure. Such a break is necessary to prevent a possible reaction called “thermal crisis,” characterized by asthenia, migraines, insomnia, malaise, and increased joint pain, which can manifest after the third or fourth bath.<sup>16,21</sup>

This particular method described is also used today to treat many RDs such as OA.

## Methodology

We conducted a search of the literature in January 2013. We searched PubMed and Scopus (the period examined was 1980–2012) for clinical trials examining the effect of PTT in OA.

MEDLINE was searched using the term “phytothermotherapy” and “hay baths” in combination with “osteoarthritis.” We included only papers published in English or

Italian and in peer-reviewed journals. Diagnosis of OA met American College of Rheumatology criteria.<sup>22,23</sup>

## Results

### Clinical studies in OA

We identified three trials describing the results of PTT in OA (Table 1). To verify the efficacy of PTT in OA, Miori et al<sup>16</sup> performed an open study on 27 patients (15 of them with a generalized OA form). The following clinical features were considered: pain in affected joints evaluated by Visual Analog Scale (VAS), presence of global subjective improvement (or lack of it) at the end of the therapy and 6 months after treatment, degree of global functional impairment, morning stiffness duration, and handgrip strength. The mean score at the affected joints (on the VAS) was  $2.51 \pm 0.71$  before and  $1.83 \pm 0.89$  after treatment ( $P < 0.001$ ), with improvement in 68% of patients. Morning stiffness was reduced from  $38.9 \pm 30.5$  to  $17.5 \pm 17.2$  minutes ( $P < 0.05$ ), with improvement in 57% of patients. Grip strength measure went from  $136 \pm 59.7$  mmHg to  $147 \pm 51$  mmHg ( $P < 0.01$ ), with improvement in 77% of patients. Patient general assessment demonstrated an improvement in 72% of cases immediately after treatment and in 80% after 6 months. Tolerability was high in 23 out of 27 patients. Nobody was taken off treatment because of side effects, although in two cases a 1-day interval due to asthenia was introduced.

In another observational study, Miori et al<sup>24</sup> reported the long-term efficacy of one cycle of PTT in a group of patients affected by gonarthrosis, in comparison with the outcome of a conventional medical treatment and physiokinesitherapy (FKT). A total of 142 patients with primary knee OA were included in the study: 54 patients (group 1) were treated with a single course of PTT, 58 patients (group 2) continued

with their usual outpatient care, and 30 patients (group 3) were treated with a course of FKT. For each group of consecutively treated patients, the authors evaluated the Lequesne algofunctional index,<sup>25</sup> a validated, disease-specific questionnaire addressing in a single index knee pain (five questions scored on a 0–2 scale, with 0 indicating absent and 2 indicating severe), function limitation (four questions, same scale), and maximum distance walked (one question scored on a 0–6 distance scale, with 0 indicating ability to walk unlimited distances and 6 indicating ability to walk <100 meters); the worst possible total score is 24 points. The drug consumption and the frequency of the patient–physician contact after 10–15 days of treatment and at 3, 6, 9, and 12 months with blind telephonic follow-up were also investigated. In each group, the Lequesne algofunctional score diminished at the end of the treatment and remained lower than at basal time in group 1 and group 2, but not in group 3, at 3, 6, 9, and 12 months. This study underlines the mild long-term (follow-up 6 months) efficacy of grass baths on both pain and functionality in knee OA. These data were recently confirmed by Fioravanti et al<sup>26</sup> in a single-blind, controlled randomized trial in patients with primary symptomatic OA of the knee, hip, and lumbar spine. Two hundred and eighteen outpatients of both sexes (83 males, 135 females) affected by primary knee or hip OA who met the American College of Rheumatology criteria<sup>22,23</sup> and patients with lumbar spine OA defined at X-ray by disc space narrowing and at least one level of osteophyte or osteosclerosis<sup>27</sup> were included in the study. All patients had been symptomatic (VAS >30 mm) for at least 3 months prior to inclusion in the study. Patients were randomly allocated into two groups: group 1 (109 patients) were submitted to PTT at the thermal center of Garniga Terme (Trento, Italy) and group 2 (109 patients) as a control group

**Table 1** Clinical trials of PTT in OA

Author	OA localization	Trial design	Sample size	Intervention	Main outcomes	Follow-up	Results
Miori et al <sup>16</sup>	15 patients with generalized OA	Open study	27	Group 1: PTT	VAS, morning stiffness, grip strength, patient general assessment	24 weeks	General improvement of all parameters persisting after 24 weeks
Miori et al <sup>24</sup>	Knee OA	Observational study	142	Group 1: PTT Group 2: outpatient care Group 3: FKT	Lequesne index, drug consumption, frequency of physician and clinical examinations	48 weeks	Persisting improvement of Lequesne Index after 8 weeks in groups 1 and 2
Fioravanti et al <sup>26</sup>	Knee, hip, and lumbar OA	SB-RCT	218	Group 1: PTT Group 2: outpatient care	VAS, HAQ, Lequesne index, RMQ, drug consumption	12 weeks	Persisting efficacy of PTT in group 1

**Abbreviations:** FKT, physiokinesitherapy; HAQ, Health Assessment Questionnaire; OA, osteoarthritis; PTT, phytothermotherapy; RMQ, Roland Morris Questionnaire; SB-RCT, single-blind randomized clinical trial; VAS, Visual Analog Scale.

and continued regular outpatient care (exercises, NSAIDs, and/or analgesics). Group 1 patients were submitted to ten generalized daily immersions of 20 minutes each in warm (50°C–58°C) hay baths. Patients in both groups were advised to note daily in a diary their consumption of analgesics and NSAIDs. Patients were assessed at baseline, after 2 weeks, and after 3 months from the beginning of the study and were evaluated by VAS for pain intensity, Health Assessment Questionnaire (HAQ),<sup>28</sup> Lequesne index for hip and knee OA,<sup>25</sup> Roland Morris Questionnaire for lumbar spine OA (an important tool to assess function of patients with low back pain),<sup>29</sup> and symptomatic drug consumption. In patients treated with PTT, the authors observed a significant improvement of VAS at the end of the treatment and 3 months later, and in the HAQ index after 15 days. Furthermore, a significant reduction of NSAID consumption was reported in group 1. In the control group, no significant differences were noted, compared with the basal time. The analyses performed separately for each subgroup of OA localization showed that the best results were evident in lumbar spine OA patients. In particular, the Roland Morris Questionnaire decreased significantly ( $P < 0.001$ ) after treatment and remained stable during the rest of the follow-up period, whereas in the control group there was not a significant modification of the RMQ score in any of the follow-up assessments. Concerning tolerability, in the group treated with PTT, 10% of patients presented side effects due to treatment, but these were of low intensity and did not interrupt the therapy. In conclusion, this study showed the beneficial carryover symptomatic effects of a cycle of PTT in patients with OA of the hip, knee, or lumbar spine.

## Tolerability

Studies performed on the behavior of a series of physiological parameters<sup>30,31</sup> and careful monitoring for possible onset of side effects, mainly in patients presenting comorbidities and of advanced age, have demonstrated the excellent tolerability of PTT. Exclusion criteria are basically limited to those patients with nonstabilized ischemic cardiopathies, decompensated nephropathies, cardiopathies and hepatopathies, other serious internistic forms, neoplasms skin pathologies involving a continuous cutaneous lesion, acute inflammatory processes, or active phlebitis or phlebothrombosis. Patients presenting articular forms in a phase of evident phlogistic activity also need to be excluded, as well as patients with a known personal history of allergies, hay fever, pollen allergies, or food intolerances.<sup>30,31</sup> Few cutaneous papules, usually nonitchy, frequently appear, resolving themselves spontaneously in a few days simply by continuing with the cure. Ten percent of patients may suffer

a worsening of the joint pain symptomatology immediately after completing the entire baths cycle; however, this does not entail a reduction of the benefits seen during medium and long-term follow-up. The presence of arthroprosthesis of the lower extremities is not considered a contraindication.

## Mechanisms of action

As for other thermal therapies, the actual mechanisms of action of PTT are not yet completely known, although they are probably ascribable to a series of different combined mechanical, physical, chemical, and physiochemical effects.<sup>32,33</sup> Such mechanisms may be distinguished specifically as common to hot baths in general, and specifically as dependent upon the composition of the particular herbs used.<sup>20</sup> It has been reported that hot stimuli produce analgesia on nerve endings by increasing the pain threshold. According to the “gate theory,” pain relief may be due to the temperature and hydrostatic pressure of water on the skin.<sup>34</sup> Moreover, thermal stimulation increases the extensibility of collagen-rich tissues, such as tendons, fasciae, and articular capsules, which may improve the range of joint motion.<sup>32</sup> These effects of PTT on muscle tone, joint mobility, and pain intensity may be effective in all the RDs, especially in OA characterized by painful symptoms and prolonged muscle tension. The baths’ high temperatures induce rapid superficial hyperemia together with an initial deep decongestion, followed by active hyperemia of the deep tissues, including periarticular tissues (capsules, ligaments). It has been demonstrated by measuring limb circumference, by bioimpedance analysis, and by measuring skin moisture that by the end of the PTT treatment there is a marked reduction in tissue imbibition.<sup>31</sup> Furthermore, thermal stress provokes a series of neuroendocrine reactions. In particular, the heat stimulates the release of adrenocorticotrophic hormone, cortisol, prolactin, and growth hormone, although it does not alter the circadian rhythm of these hormones.<sup>35</sup> The effect of thermal stress on the hypothalamus–pituitary–adrenal axis seems to be particularly important for the antiedemigenous and anti-inflammatory actions of corticosteroids, as well as for the frequent alteration of the axis during some RDs.<sup>36</sup> The increase in  $\beta$ -endorphin demonstrated to occur with various spa therapy techniques<sup>37–40</sup> has an analgesic and antispastic effect that is particularly important in patients for whom pain is the prevalent symptom. This increase in  $\beta$ -endorphin is probably the key factor in the mechanism of individual tolerance to thermal baths. The effects described make it possible to break the vicious circle of pain–muscle

contraction-altered joint dynamics pain that characterizes many chronic arthropathies.

Furthermore, recent studies have shown after various spa therapy techniques a reduction of circulating levels of prostaglandin  $E_2$  and leukotriene  $B_4$ , which are important mediators of inflammation and pain, in patients suffering from OA.<sup>41,42</sup>

Moreover, in patients with OA, PTT induces an increase of blood levels of heat shock protein such as Hsp70.<sup>43</sup> In cell cultures of chondrocytes and in animal models of arthritis, Hsp70 has been shown to provide protection from cellular injuries and apoptosis.<sup>44</sup> Specific effects of PTT may be due to the active ingredients (essential oils, terpenes, and other aromatic substances) contained in the fermenting grass, which, favored by vasodilatation, enter the body during the bath.<sup>45</sup>

Other specific factors may also contribute to the clinical improvement observed after PTT, including the change in environment, pleasant scenery/surroundings, the absence of work duties, physical and mental relaxation, the noncompetitive atmosphere with similarly suffering companions, and physical therapy. These spa benefits are especially important in studies evaluating the effects of PTT compared with no treatment or another treatment.<sup>32,33,46,47</sup>

## Discussion

The aim of this review was to summarize the currently available information on clinical effects and mechanisms of action of PTT in OA. The results of clinical trials on PTT that we have described here suggest a positive effect in decreasing OA pain and improving articular functionality. The studies assessed the medium to long-term effect and found that the clinical efficacy of PTT lasted for 3–6 months. The persistent symptomatic effects of PTT in OA demonstrated in clinical studies are in line with those of other trials of spa therapy for various RDs performed previously<sup>27,48–53</sup> and with our previous contribution on PTT in patients affected by fibromyalgia.<sup>54</sup> Nguyen et al<sup>27</sup> reported that spa therapy of 3 weeks' duration had a carryover of beneficial symptomatic effects (6 months) in patients with lumbar spine, knee, and hip OA. Guillemin et al<sup>49</sup> concluded that the addition of spa therapy for patients with low back pain had a positive short-term and a moderate long-term (9 months) effectiveness on chronic low back pain. van Tubergen et al<sup>50</sup> reported that in patients with ankylosing spondylitis, a 3-week course of combined spa and exercise therapy, in addition to drug treatment, provided beneficial effects for at least 40 weeks. In a previous study,<sup>54</sup> we investigated the effects of PTT in patients affected by fibromyalgia, demonstrating pain relief and significant improvement of the

fibromyalgia-related symptoms and quality of life during follow-up (12 and 24 weeks). Moreover, PTT seems to be well tolerated, with slight and transitory side effects.

On the other hand, it is important to underline that in literature there is a great lack of studies in the field of PTT and OA. Furthermore, some aspects of these studies are disputable and could be a source of bias. For example, comparisons of the studies were difficult. In these trials the baseline characteristics of the patients were heterogeneous, the methods used for assessment of efficacy varied, and the patients were assessed at different times after PTT (Table 1).

Only one of the studies reported is randomized and none has a double-blind design, because of the difficulty of creating a placebo with the same characteristics as the treatment. Because of the lack of double-blinded studies, the placebo effect cannot be excluded and may contribute to confound results.

Furthermore, the mechanisms of action of PTT are not fully understood, and one of the critical points is the controversial problem of the absorption of the active ingredients (essential oils, terpenes, and other aromatic substances) contained in the fermenting grass: ie, the demonstration of specific effects other than those linked to the simple action of heat. Unfortunately, few studies have been conducted on this topic, and little is known about the specific effects of various fermenting grasses. This lack of evidence is also linked to the ongoing controversy in the health care professions concerning the role of alternative medicine, which includes, among others, PTT. Some proponents of alternative medicine feel that its value has been established by traditional use and it should be integrated into medical education and practice, whereas others are skeptical about this field because of the lack of scientific medicine. Hoping to overcome these controversies, more botanical investigations and research on the mechanisms of action of PTT are not only necessary but even advisable.<sup>55</sup>

## Conclusion

PTT could represent a useful aid in the treatment of some RDs such as OA. This therapy could also represent a good alternative for all those patients who cannot tolerate conventional pharmacologic treatments or are at risk of serious side effects.

The value of this therapeutic approach largely depends on the respect of some basic general rules, such as a correct diagnosis and characterization of the evolutionary phase of the disease, the accurate assessment of the patient's general health status to exclude potential contraindications, and a good knowledge of the therapeutic medium utilized, including its indications and possible side effects.



Given the positive preliminary results of PTT in the treatment of patients with OA, further clinical investigations on larger populations and different RDs are highly recommended, in order to widen the indications of this treatment modality and reduce the impact of drug toxicity and side effects.

## Disclosure

All authors declare no conflicts or competing financial interests in this work.

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