


# Balneotherapy for Musculoskeletal Pain Management of Hot Spring Water in Southern Ethiopia: Perceived Improvements

INQUIRY: The Journal of Health Care Organization, Provision, and Financing  
Volume 58: 1–7  
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DOI: 10.1177/00469580211049063  
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## Abstract

**Background:** Balneotherapy and hydrotherapy offer interesting treatment alternatives and are commonly used as additional interventions in the management of musculoskeletal disorders and pain management. Therefore, the aim of this study was to assess the effect of balneotherapy on musculoskeletal disorder pain and its perceived improvement among users of hot spring water in Southern Ethiopia. **Methods:** A single-arm cohort study and convenient sampling method were used to select 1337 study participants from four hot springs in Southern Ethiopia. A structured questionnaire, a physical examination, and laboratory blood tests were used to collect data. Data were entered using Epi data and transferred to SPSS 25 for cleaning and analysis. Descriptive analysis was made. **Results:** A total of 1279 participants were included in the study, giving a response rate of 96%. The majority of these patients have multiple health problems. Of all, 1137 (88.9%) of the patients were visiting the hot springs for joint pain followed by muscle pain 669 (52.2). Out of all cases of joint pain, 132 (11.6%) were clinically diagnosed with rheumatoid arthritis, and 5.3% were confirmed as having the disease based on a laboratory test. Of the total number of study participants, 1064 (83.2%) reported complete relief from the complaints they had at the start of the bath. **Conclusions:** Hot spring baths for three and more days have significant therapeutic effects on patients with musculoskeletal disorders, including rheumatoid arthritis. Physicians who are currently working in the area of diagnosis and treatment of patients in government and public facilities of the southern region should consider hot spring bath treatment for those patients with complaints of musculoskeletal pain, nonspecific arthritis, and rheumatoid arthritis. A hot spring bath is beneficial for everyone because it is a natural treatment with few side effects and a low cost.

## Keywords

hot springs, balneotherapy, musculoskeletal disorder, pain management, Southern Ethiopia

What do we already know about this topic?

There is no adequate information about the use of hot springs bath.

Balneotherapy was not well understood by medical staff as an alternative therapy.

- How does your research contribute to the field?

Most patients with chronic musculoskeletal conditions traditionally sought a solution to their problem. It is good to provide information about thermal baths at healthcare facilities.

- What are your research's implications toward practice?

Fortunately, our community believes that hot spring bath is a natural remedy. However, the modern medicine not practically integrated with that of the traditional therapy. It is useful if a physician prescribe a hot spring bath as a supportive

treatment alternative for the management of specific and nonspecific musculoskeletal disorder pain. This is accessible and affordable for most people with lower economic status.

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Physicians need to be aware of the use of natural thermal baths and reduce addiction to medication management and incurring unnecessary cost and drug side effect.

## Introduction

The term balneotherapy is seated immersion or spa-therapy. Often, natural mineral or thermal waters are used for bathing, drinking, and inhalation.<sup>1</sup> Balneotherapy and hydrotherapy offer interesting treatment alternatives and are commonly used as additional interventions in the management of musculoskeletal disorders and pain management.<sup>2</sup>

Musculoskeletal conditions, also called musculoskeletal disorders, consist of conditions where a part of the musculoskeletal system is injured or affected over time. Symptoms include pain, function, or discomfort in the bones, joints, muscles, or surrounding structures, which can be acute or chronic, focal or diffuse. The most frequent musculoskeletal disorders are osteoarthritis, fibromyalgia, rheumatoid arthritis, and low-back pain.<sup>3</sup>

Nowadays, when warm water can be easily obtained from springs in any country, the question of whether this warm mineral water is of any medical importance arises. For this reason, physico-chemical analyses are the first step in order to discover these characteristics.<sup>4</sup>

Hydrotherapy, using water and heat together to treat conditions, relieve pain, and increase muscular power and a range of joint movement, has been a mainstay of managing many medical conditions. These include arthritis, neurological conditions, and rehabilitation from sports injuries.<sup>5</sup> Balneotherapy can be used to specifically improve: strength and/or prevent muscle wastage, posture, flexibility and/or prevention of contracture (shortening and hardening of muscles, tendons, or other tissue); ability to perform normal everyday activities, including walking, exercise and work tolerance, cardiovascular fitness and balance, and reaction times.<sup>5</sup>

Studies have reported a faster rate of improvement in diseases in patients using drugs with balneotherapy than drugs alone for some of the above-mentioned diseases, which in turn reduces the duration of drug exposure.<sup>6,7</sup>

The therapeutic outcome of water comes from its mechanical, thermal, and chemical effects that allow the patient to mobilize joints and strengthen muscles with minimal discomfort mechanically, vasodilatation by the higher temperature, and healing of the skin chemically with the help of minerals where, under certain conditions, resorption is possible.<sup>8,9</sup> The common elements/minerals that are said to have therapeutic properties include calcium, magnesium, sodium, potassium, sulfur/sulfate, and bicarbonates. However, despite the fact that people in Ethiopia have traditionally used hot springs for therapeutic purposes, no study has reported the effect of balneotherapy on the management of musculoskeletal disorders and pain management. Therefore, the aim of this study was to assess the therapeutic properties of the selected hot springs for the management of

musculoskeletal disorders in the southern part of the region.

## Methods

### Study Site

The study was conducted in Bersiso (Dilla district), Yirgalem (Yirgalem town), Burkitu (Hawassa city), and Wondo (Wondo district) hot water springs in the Southern Nation National People's Region (SNNPR) in 2019. The hot springs were selected randomly.

### Study Population and Period

The study population consisted of adults aged 18 and above who used immersion or bath at the selected hot springs in SNNPR during the study period. The study was conducted from March to October 2019.

### Study Design

A single-arm prospective cohort design was used to assess musculoskeletal complaints and observe patients' improvement in their musculoskeletal system complaints after utilization of hot spring water for at least 3 days. Participants were asked about their health status at the beginning of the hot spring immersion and followed for 3–10 days as per their willingness to stay and again asked about their health status at the end of the hot spring bath.

### Sample Size Determination

The sample size for the study was determined using a double population proportion formula. 80% power, 95% confidence level, AOR 2.49, and a 1:1 ratio were considered. 608 was the calculated sample multiplied by a design effect of 2 and a 10% nonresponse rate. The total sample size required for the study was 1337 persons.<sup>10</sup>

### Sampling Procedures

To include the study subjects, a convenient sampling technique was used. Based on the client's age and the availability of interesting health problems, assigned study subjects to the four hot springs in a proportional manner. An average of 334 samples were allocated to each of the four sites. Blood samples were collected, if the duration of the symptoms was greater than 2 weeks and 2–10 large joints or 1–3 small joints were involved. As a result, 132 blood samples were collected from the four hot springs sites studied.

### Inclusion/Exclusion Criteria

Inclusion: clients who were using the hot spring for health-related problem improvements and wanted to stay for at least 3 days to follow the change in signs and symptoms.

Exclusion: clients under the age of 18, those clients who came for recreational purposes, and pregnant women were also excluded.

### Variables

Socio-demographic factors, type and duration of illness, and improvement in signs/symptoms of diseases.

### Data Collection and Tools

A questionnaire that includes the signs, symptoms, and laboratory investigations needed to diagnose these specific diseases with the socio-demographic characteristics of the respondents was developed. The tool was pretested on 5% of respondents from other hot springs (Alaba site) and then modified as needed. The data collection team was selected based on educational status (medical degree holders) and proficiency in the local languages, Sidamu Afo and Amharic. The data collectors and supervisors received 2 days of training prior to data collection. Furthermore, one laboratory technician was assigned to each target site to collect blood samples, which were then properly stored and transported to the nearest hospital for laboratory testing. Examination was done for all patients enrolled in this study and who had signs and symptoms of rheumatic arthritis by the data collectors (physicians).

### Definitions

Balneotherapy use: immersion of the body in the hot springs fully or partially for a minimum of half hour a day for at least three days was considered as a user.

### Rheumatoid factor (RF)

This test measures the level of RF, which acts as an antibody against gamma globulins in the blood. And, we are interpreting the results: A person who tests positive for RF could have RA. However, doctors cannot conclude this from an RF test alone, as several other conditions can increase the amount of RF in the body, including gout. Similarly, a negative RF test result is insufficient evidence to confirm that a person does not have RA.

Erythrocyte sedimentation rate is also called ESR or “sed rate”. This test measures how fast red blood cells cling together, fall, and settle (like sediment) at the bottom of a glass tube over the course of an hour. The higher the sedimentation rate, the greater the amount of inflammation is. An elevated ESR can be caused by a variety of conditions, including infection or anemia.

The criteria established by the American College of Rheumatology (ACR) Board of Directors and the European League Against Rheumatism (EULAR) Executive Committee were used to diagnose rheumatoid arthritis. A total score of 6 or

greater from the individual scores in four domains: number and site of involved joints (score range 0-5), serologic abnormality (score range 0-3), elevated acute-phase response (score range 0-1), and symptom duration (2 levels; range 0-1).

Finally, the presences of RF and/or increased ESR, together with the symptoms typical of RA, make it more likely that a person has RA. ([Supplementary table](#)).

### Data Analysis

The data were entered using Epi Data software version 3.1 and transferred to SPSS software version 25 for analysis. Data cleaning, recoding, and analysis were done using SPSS. Descriptive statistics such as proportion mean and standard deviation measurements were used to assess the types of musculoskeletal complaints in patients using balneotherapy, and the data were coded by identifying those symptoms that were improved/not improved after using the hot spring immersion and by considering the time factor.

## Result

### Socio-Demographic Characteristics

A total of 1337 patients were enrolled in the study for the initial assessment. However, 1279 patients who had a different chronic illness were interviewed for the second time in the study, and had a response rate of 96%. The average age of the patients was 44.1 years 16.5 months. Of the 867 users, 6 (67.8%) were from rural areas, 1042 (81.5%) were married, 499 (39%) could not read or write, and 500 (39.1%) were farmers. [Table 1](#).

### Frequency of Visiting the Hot Springs and Duration of Use

Four hundred seventy-three (37%) participants visit the hot spring sites on a yearly basis, with 337 (26.3%) visiting when necessary. Overall, the mean duration of stay at the site of the hot springs was  $4 \pm 3$  days. [Table 2](#).

### Reasons for and Why the Patients Visiting the Hot Springs

The majority of the patients had multiple health problems. Of all, 1137 (88.9%) of the patients were visiting the hot springs for joint pain followed by muscle pain 669 (52.2) (see [Table 3](#)).

Patients who visited the hot springs were self-referred by 590 (46.1%), previous users by 395 (30.9%), relatives or friends by 289 (22.6%), and traditional healers by 5 (4%). 1120 (87.6%) of the patients reported that the duration of the illness was less than one year. More than two-thirds of the 1040 (81.3%) patients had not sought any help before coming to the hot spring site and 237 (18.7%) of the patients had sought help for their illness. Of these, 221 (93.3%) sought modern medicine and 16 (6.7%) sought balneotherapy.

**Table 1.** Socio-Demographic Characteristics of Patients Who Used Balneotherapy in Southern Ethiopia 2019.

Variables	Categories	Frequency	Percent
Age in years	18–29	261	20.4
	30–39	303	23.7
	40–49	248	19.4
	50–59	192	15.0
	60–69	155	12.1
	≥70	120	9.4
Sex	Male	661	51.7
	Female	618	48.3
Place of residence	Rural	867	67.8
	Urban	412	32.2
Marital status	Married	1042	81.5
	Single	145	11.3
	Widowed	71	5.6
	Divorced	21	1.7
Level of education	Unable to read and write	499	39
	Read and write	170	13.3
	Grades 1–8	397	13
	Grades 9–12	155	12.1
	College, university level	58	4.5
Occupation	Farmer	500	39.1
	House maker	389	30.4
	Merchant	157	12.3
	Daily laborer	63	4.9
	Government/NGO employee	63	4.9
	Student	50	3.9
	Others	57	4.5
	Average monthly income	<1000	772
	1000–2000	230	18
	2001–3000	147	11.5
	3001–5000	79	6.2
	>5000	51	4

**Table 2.** Frequency of Visits and Duration of Stay Among Patients Who Use Balneotherapy in Southern Ethiopia 2019.

Variables	Frequency	Percent	
Frequency of visit	Daily	193	15.1
	Weekly	114	8.9
	Monthly	162	12.7
	Yearly	473	37
	As needed	337	26.3
For how long you used	3 days	795	62.2
	4–7 days	450	35.2
	>7 days	34	2.7

### Characteristics of Musculoskeletal Health Problems

A total of 1137 (88.9%) patients reported joint pain. Of these, 489 (43%) had joint stiffness, of which 376 (76.9%) complained of morning stiffness. Of the total patients who complained of joint pain, 383 (33.7%) had tenderness (pain during touch over the joint), 141 (11%) had joint swelling with a mean length of  $6.6 \pm 3.2$  cm and a mean width of  $6.7 \pm 6.4$  cm, and 45 (3.9%) of the patients had a skin lesion over

the joint. More than half of the patients, 640 (56.3%), reported the symptoms started less than 6 weeks. A total of 669 (52.3%) of the patients have also reported generalized muscle pain. Knee (619, 54.4%) was the most commonly affected joint, followed by the hip (324, 28.5%) (see [Table 3](#)).

### Rheumatoid Arthritis and Laboratory Test Results of Rheumatoid Factor and Erythrocyte Sedimentation Rate

All 132 (10.3%) patients who got a score of 2 points and more (had complained of one or more joint pain for the duration of six or more weeks) were clinically suspected of rheumatoid arthritis, and then a blood sample was sent for serologic tests, namely, RF and ESR. All of the patients consented verbally, and a blood sample was taken for a laboratory examination. The majority of 125 (94.7%) of the laboratory results were negative. 7/132 (5.3%) were positive for RF and 6/132 (4.5%) were positive for ESR, with 3 of the blood samples being highly positive and 4 being low positive. Therefore, 7 (5.3%) who got a score of six or more were considered to have confirmed rheumatoid arthritis.

**Table 3.** Types of Joints Involved Among Patients Who Complain Joint Pain and Use Balneotherapy at Southern Ethiopia, 2019. N = 1279.

Types of Involved Joint	Frequency	Percent
Knees	619	54.4
Hips	324	28.5
Ankles	309	27.2
Shoulders	161	14.2
Elbows	148	13
2–10 large joints	140	12.3
Wrist	60	5.3
MCP	14	1.2
Thumb	14	1.2
2–5 <sup>th</sup> MCP	12	1
PIP	6	.5
4–10 small joints involved	4	.3
>10 joint involved with at least one small joint	1	.08

**Table 4.** Types of Illness and Therapeutics Effects of Hot Bath Among Patients Who Used Balneotherapy in Southern Ethiopia, 2019. N = 1279.

Types of Illness	Duration of Use of Hot Bath	Completely Improved	Partially Improved	No Change
Joint pain	3 days	786	65	9
	4–7 days	118	24	3
	>7 days	55	7	70
Joint stiffness	3 days	55	5	0
	4–7 days	23	8	1
	>7 days	11	0	9
Joint swelling	3 days	8	1	1
	4–7 days	4	2	0
	>7 days	5	0	5
Muscle pain	3 days	474	24	6
	4–7 days	70	10	3
	>7 days	28	4	50

### Improvement Status of the Patients After the Utilization of Balneotherapy

A total of 1279 patients were re-interviewed about their progress and the effect of the hot bath after 3 days of minimal use. Of the total study participants who used balneotherapy, 1064 (83.2%) reported being completely relieved from the complaints they had, 117 (9.1%) were partially improved and 98 (7.7%) of the patients had no change (see Table 4).

### Discussion

To the best of our knowledge, this is the first study in the area which assessed the therapeutic properties of selected hot springs among patients who were visiting the site. Accordingly, the majority of the patients had multiple health problems. Of all, 1137 (88.9%) of the patients were visiting the hot springs for joint pain and muscle pain, 669 (52.2%). Out of all cases of joint pain, 132 (11.6%) were clinically diagnosed with rheumatoid arthritis, and 5.3% were confirmed as having the

disease based on a laboratory test. Of the total number of study participants, 1064 (83.2%) reported complete relief from the complaints they had at the start of the bath.

Our study shows that the predominant users of the hot spring bath were patients with joint problems like joint pain, stiffness, and swelling. This is consistent with a systematic review on balneotherapy in medicine, which cites the United States for the beneficial effects of spa therapy on a variety of diseases and conditions.<sup>11,12</sup>

The study showed that patients with musculoskeletal pain were among the dominant users of the hot springs bath. This is because the patients were referred to them by the previous users to visit the site of the hot springs. The hot spring bath's effectiveness is communicated to those who benefit from it. The finding contradicts studies conducted in the United States, which found that using a hot spring bath for non-specific joint pain resulted in a significant reduction in pain intensity.<sup>12,13</sup> It has been reported that balneotherapy exerts some beneficial effects on the immune system likely due to its chemical, thermal, and mechanical properties.<sup>14</sup>



Patients with rheumatoid arthritis were also among the patients who visited the hot spring site for a hot spring bath. In addition, the majority of cases reported perceived relief of joint pain and swelling. This is because studies have confirmed that a hot bath increases muscle relaxation, reduces joint load, and increases hemodilution and diuresis.<sup>13,15</sup> In addition, studies suggested that balneotherapy results in increased hormone production and effect on immune system.<sup>14-16</sup>

Patients with muscle pain are also frequent users of hot spring baths, and they report pain relief after at least 3 days of use. Hot spring water baths have also been shown in studies to significantly reduce pain.<sup>12,13</sup> This is due to the heat or the ionic elements of the water.<sup>13,17</sup>

## Conclusion

Hot spring baths for three and more days have significant therapeutic effects among patients with musculoskeletal disorders, including rheumatoid arthritis. Physicians who are currently working in the area of diagnosis and treatment of patients in government and public facilities of the southern region should consider hot spring bath treatment for those patients with complaints of musculoskeletal pain, nonspecific arthritis, and rheumatoid arthritis. A hot spring bath is beneficial for everyone because it is a natural treatment with few side effects and a low cost. Further study might be useful to have a concrete knowledge in wider area and the entire aspects of the balneotherapy.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Acknowledgments

The authors express great thanks to the Hawassa University, Research and technology transfer directorate office for their financial support. I express heartfelt gratitude to Mrs Simegne Serka for her unreserved encouragement and constructive guidance and to data collectors, laboratory workers, and patients who participated in this study for their willingness to share their health status. All authors declare that the submitted work has not been published before (neither in English nor in any other language) and that the work is not under consideration for publication elsewhere.

## Author Contributions

All authors contributed to the conceptualization, methodology, writing original draft preparation, and review and editing work of this manuscript.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Ethical Approval

Ethical clearance was secured from the Institutional Review Board (IRB) of the College of Medicine and Health Sciences, Hawassa University. The reference number is IRB/041/19. The respondents' verbal consent was obtained before the data were collected. Before collecting the blood samples from those who are eligible, the purpose and benefits of the study are clearly described. After doing so, their permission was obtained. Furthermore, permission was granted by the owners of the hot springs.

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## Supplemental Material

Supplemental material for this article is available online.

## References

1. Bennett RM, Jones J, Turk DC, Russell IJ, Matallana L. An internet survey of 2,596 people with fibromyalgia. *BMC Musculoskel Disord.* 2007;8:27.
2. Gutenbrunner C, Bender T, Cantista P, Karagülle Z. A proposal for a worldwide definition of health resort medicine, balneology, medical hydrology and climatology. *Int J Biometeorol.* 2010;54:495-507.
3. Felson DT. Epidemiology of the rheumatic diseases. In: Koopman W, ed. *Arthritis and Allied Conditions*. Lippincott, Williams and Collens; 2000.
4. Alessio P, Roberto D, Alessandra M, Silvio T, Enrico V, Francesco C, et al. Thermal balneotherapy in Antsirabe-Madagascar: water analysis and its applications in an African context. *Acta Biomed.* 2016;87(1):25-33.
5. Cavanah C. *Wet Areas. Guide to Hydrothermal Spa and Wellness Development Standards. What You Need to Know before Building*. Global Wellness Institute; 2016.
6. Routh HB, Bhowmik KR, Parish LC, Witkowski JA. Balneology, mineral water, and spas in historical perspective. *Clin Dermatol* 1. 1996;14:551-554.
7. Waning B, Montagne M. *Pharmacoepidemiology Book: Principles and Practices*. McGraw-Hill; 2001 Chapter 9.
8. O'Hare JP, Heywood A, Summerhayes C, Lunn G, Evans JM, Walters G, et al. Observations on the effect of immersion in bath spa water. *BMJ Sexual and Reprod Health.* 1985;291:1747-1751.
9. Adler E. Some clinical experience with the springs at Zohar on the shore of the Dead sea. *Isr J Med Sci.* 1961;20:304-308.
10. Melese H, Gebreyesus T, Alamer A, Berhe A. Prevalence and associated factors of musculoskeletal disorders among cleaners

- working at mekelle university, Ethiopia. *J Pain Res.* 2020;13:2239-2246. DOI: [10.2147/JPR.S263319](https://doi.org/10.2147/JPR.S263319).
11. Ali N, Sadanobu K. Balneotherapy in medicine: A review. *Environ Health Prev Med.* 2005;10:171-179.
  12. Ortega E, Gálvez I, MDea H. Anti-inflammatory effect as a mechanism of effectiveness underlying the clinical benefits of pelotherapy in osteoarthritis patients: regulation of the altered inflammatory and stress feedback response. *Int J Biometeorol.* 2017;61:1777-1785.
  13. Baloglu S, Busser J, Cain L. Impact of experience on emotional well-being and loyalty. *J Hospit Market Manag.* 2019;28(4):427-445.
  14. Scanu A, Tognolo L, Maccarone MC, Masiero S. Immunological events, emerging pharmaceutical treatments and therapeutic potential of balneotherapy on osteoarthritis. *Front Pharmacol.* 2021;12:681871. doi:[10.3389/fphar.2021.681871](https://doi.org/10.3389/fphar.2021.681871).
  15. Masiero S, Maccarone MC, Magro G. Balneotherapy and human immune function in the era of COVID-19. *Int J Biometeorol.* 2020;64(8):1433-1434. doi:[10.1007/s00484-020-01914-z](https://doi.org/10.1007/s00484-020-01914-z).
  16. Maccarone MC, Magro G, Solimene U, Scanu A, Masiero S. From in vitro research to real life studies: an extensive narrative review of the effects of balneotherapy on human immune response. *Sport Sci Health.* 2021:1-19. Online Ahead of Print, 2021 May 20. doi:[10.1007/s11332-021-00778-z](https://doi.org/10.1007/s11332-021-00778-z).
  17. Becker BE. The biologic aspects of hydrotherapy. *J Back Musculoskelet Rehabil.* 1994;4:255-264.