

Dan Buskila · Mahmoud Abu-Shakra · Lily Neumann  
Lisa Odes · Evgeny Shneider · Daniel Flusser  
Shaul Sukenik

## Balneotherapy for fibromyalgia at the Dead Sea

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**Abstract** The aim of this study was to evaluate the effectiveness of balneotherapy on patients with fibromyalgia (FM) at the Dead Sea. Forty-eight patients with FM were randomly assigned to a treatment group receiving sulfur baths and a control group. All participants stayed for 10 days at a Dead Sea spa. Physical functioning, FM-related symptoms, and tenderness measurements (point count and dolorimetry) were assessed at four time points: prior to arrival at the Dead Sea, after 10 days of treatment, and 1 and 3 months after leaving the spa. Physical functioning and tenderness moderately improved in both groups. With the exception of tenderness threshold, the improvement was especially notable in the treatment group and it persisted even after 3 months. Relief in the severity of FM-related symptoms (pain, fatigue, stiffness, and anxiety) and reduced frequency of symptoms (headache, sleep problems, and subjective joint swelling) were reported in both groups but lasted longer in the treatment group. In conclusion, treatment of FM at the Dead Sea is effective and safe and may become an additional therapeutic modality in FM. Future studies should address the outcome and possible mechanisms of this treatment in FM patients.

**Key words** Fibromyalgia · Dead Sea · Balneotherapy

### Introduction

Although significant effort has been devoted to determining the etiopathogenesis of fibromyalgia (FM), its

treatment still constitutes a challenge. Given the complexity and chronicity of the clinical manifestations of FM patients and their relatively poor response to medications, it is not surprising that several nonpharmacologic treatment interventions have been tested [1]. Indeed, it has been documented that patients with FM are high consumers of alternative medicine interventions and express high satisfaction with treatments by alternative practitioners [2].

Balneotherapy has been practiced for centuries in the management of rheumatic diseases. In Israel, the main health resort area providing balneotherapy is located along the western shore of the Dead Sea at the southern end of the Jordan River. The Dead Sea is the world's lowest and most saline lake. A salt content of about 30% (300 g/l) makes its salinity ten times that of oceans.

We have previously shown [3] that 2-week periods of therapy with sulfur baths or mud packs alone or in combination were effective in patients with rheumatoid arthritis (RA). In two additional studies, Dead Sea salts dissolved in a bath at home and Dead Sea mud packs were also found to be effective [4,5]. Furthermore, daily exposure to the sun and bathing in the Dead Sea were highly effective therapies in psoriasis and psoriatic arthritis. The addition of balneotherapy with mud packs and sulfur baths enhanced the improvement observed in both skin and joints of these patients [6].

The aim of the present study was to evaluate the effectiveness of sulfur bath balneotherapy in patients with FM.

### Materials and methods

#### Subjects

The 48 subjects tested were chosen at random from a list of female FM patients attending the rheumatology outpatient clinic of the Soroka University Hospital, Beer Sheva, Israel. This clinic serves as a tertiary referral center for the southern part of Israel. All subjects fulfilled 1990 American College of Rheumatology (ACR) criteria for the classification of FM [7].

D. Buskila (✉) · M. Abu-Shakra · L. Neumann · L. Odes  
E. Shneider · D. Flusser · S. Sukenik  
Rheumatic Disease Unit, Division of Internal Medicine,  
Soroka Medical Center and Ben-Gurion University,  
P.O. Box 151, Beer Sheva 84101, Israel  
E-mail: Lily@bgumail.bgu.ac.il  
Fax: +972-7-6403534

L. Neumann  
Epidemiology Department, Faculty of Health Sciences,  
Ben-Gurion University of the Negev, Beer Sheva 84101, Israel

The patients were randomly allocated into treatment and control groups of 24 subjects each. Balneotherapy in the treatment group was based on bathing for 20 minutes daily in a sulfur pool at 37°C, while the control group did not receive this treatment. The water in the sulfur bath was taken from spring water on the Northern shore of the Dead Sea, and the concentration of sulfur ions in the bath was 2000 mg/l. No subject in either group received any additional treatment. All participants stayed at the Dead Sea area for 10 days and were asked to continue their regular medications for FM.

All patients were assessed by a rheumatologist blinded to the mode of treatment. Physical functioning, FM-related symptoms, and tenderness (point count and dolorimetry thresholds) were evaluated.

The patients were first examined at the Rheumatic Disease Clinic of the Soroka Medical Center 2–3 days before arrival at the Dead Sea (time 1), at the spa hotel clinic at the end of their stay (10 days) (time 2), and at the Rheumatic Disease Clinic 1 and 3 months (times 3 and 4, respectively) after completion of the study.

The study was approved by the Helsinki Ethics Committee of the Soroka Medical Center. All participants gave written informed consent.

## Measurements

### *Fibromyalgic symptoms*

Visual analog scales (VAS) were used by each patient to evaluate current levels of pain, anxiety, depression, fatigue, morning stiffness, and global well-being. The scale was labeled from “no pain” to “worst pain.” The items were scored on a 0–10 scale, with 10 points denoting the worst possible condition. In addition, the following symptoms were recorded by the interviewer as present or absent: sleep disturbance, headache, paresthesias, subjective joint swelling, and irritable bowel syndrome (IBS).

### *Physical functioning*

Physical functioning was assessed by the Fibromyalgia Impact Questionnaire (FIQ) developed and validated by Burckhardt et al. [8] to assess the current health status of women with FM. The part of the FIQ used in the present study is a brief, ten-item instrument that measures physical functioning on a 0–3 scale, where 3 = never able to do. This instrument was recently translated into Hebrew and validated by us [9].

### *Functional disability*

Functional Disability Index (FDI) of the Health Assessment Questionnaire was used to assess disability [10]. In it, two or three questions are asked in each of eight activities of daily living (ADL) areas: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and activities. Scoring within each section is from 0 (without any difficulty) to 3 (unable to do). The score given to a section is the worst score within that section. If an aid or device is used or assistance is required from another individual, then the minimum score for that section is 2. The average score of the eight sections is the FDI, which ranges from 0 to 3, with 0 corresponding to maximal functional ability.

### *Tenderness assessment*

Tenderness assessment was performed manually and by dolorimeter. In all subjects, a count of 18 tender points (TP) was performed by thumb palpation. Threshold of tenderness was measured using a Chatillon dolorimeter [11] at nine tender points and four control points. The subject was asked to say “yes” when the sensation changed from pressure to definite pain. Preliminary measurements

of the control sites were obtained not only to familiarize the subject with the process but also to discourage anticipation or exaggerated responses. Patients were not told which points were tender and which were control points, and the points were mixed together in the examination. All dolorimeter measurements of the 13 point sites as well as a total point count were done by one observer before assessment of FM symptoms.

## Statistical analysis

T-tests for independent samples were used to compare means of variables in the treatment and control groups. Time and group effects were assessed by two-way repeated measurements analysis of variance [12].

## Results

The demographic and clinical characteristics of FM patients in the treatment and control groups are summarized in Table 1. No statistically significant differences were observed on any variable, specifically age, disease duration, pain, fatigue, and tenderness measurements (point count and dolorimetry threshold).

Tables 2 and 3 compare physical disability and functioning, tenderness measurements, and the severity and frequency of FM-related symptoms in the two groups at the four time points.

Measurements of physical functioning (both FDI and FIQ) as well as the two measurements of tenderness (point count and dolorimetry threshold) show improvement following the stay at the Dead Sea (Table 2). Excepting tenderness threshold, the improvement was especially notable in the treatment group, persisting even after 3 months.

A significant improvement in symptom severity based on patient self-assessment (pain, fatigue, stiffness, and anxiety) was found in both groups and lasted for at least 3 months in the treatment group (Table 3). A reduction in the frequency of FM-related symptoms such as headache, sleep problems, and subjective joint swelling was observed in both groups, while the frequency of IBS decreased in the treatment group only (Table 3). Except

**Table 1** Demographic and clinical background of treatment and control groups. (All differences are statistically insignificant;  $P > 0.05$ )

Variable	Treatment group ( $n = 24$ )	Control group ( $n = 24$ )
Mean age, years (SD)	54.6 (8.4)	54.3 (8.0)
Married (%)	70.8	83.3
Employed (%)	50.0	41.7
Mean years education (SD)	10.3 (5.0)	9.3 (4.3)
Mean disease duration, years (SD)	11.1 (12.2)	9.4 (8.9)
Mean pain (0–10 <sup>a</sup> ) (SD)	8.0 (1.9)	8.7 (1.4)
Mean fatigue (0–10 <sup>a</sup> ) (SD)	8.3 (1.9)	8.5 (1.6)
Mean point control (0 <sup>a</sup> –18) (SD)	16.0 (2.4)	16.0 (2.4)
Mean tenderness <sup>b</sup> threshold (0–9 <sup>a</sup> ) (SD)	2.2 (0.5)	2.3 (0.8)

<sup>a</sup> Best possible score

<sup>b</sup> Mean at nine tender points

**Table 2** Physical functioning and tenderness measurements by group and time. (FDI functional disability index, FIQ Fibromyalgia Impact Questionnaire score for physical functioning)

Variable (range)	Treatment group time				Control group time				Significance <sup>b</sup>	
	1	2	3	4	1	2	3	4	Time effect	Group effect
FDI (0–3 <sup>a</sup> )	1.2	0.7	0.9	0.7	1.1	0.8	0.9	1.0	0.001	0.720
FIQ (0–3 <sup>a</sup> )	1.7	1.6	1.4	1.4	1.9	1.7	1.6	1.7	0.082	0.254
Point count (0–18 <sup>a</sup> )	16.0	13.8	13.8	13.9	16.0	15.9	15.5	16.1	0.098	0.037
Tenderness threshold (0–9 <sup>a</sup> )	2.2	3.1	2.4	2.2	2.3	2.5	2.4	2.0	0.001	0.288

<sup>a</sup>Best possible score

<sup>b</sup>Repeated measurements by two-way analysis of variance

**Table 3** Symptoms by group and time

Variable	Treatment group time				Control group time				Significance	
	1	2	3	4	1	2	3	4	Time effect	Group effect
VAS symptoms										
Pain <sup>a</sup>	8.0	6.0	6.8	7.0	8.7	7.7	8.2	8.3	0.004	0.017
Fatigue <sup>a</sup>	8.3	7.9	7.0	6.8	8.6	7.6	7.8	7.7	0.004	0.261
Stiffness <sup>a</sup>	8.0	6.6	6.9	7.1	7.7	6.3	6.8	6.1	0.044	0.479
Anxiety <sup>a</sup>	4.0	2.7	4.0	3.9	2.8	2.5	3.9	5.2	0.008	0.991
Depression <sup>a</sup>	4.0	4.2	4.0	3.8	3.1	2.8	2.5	4.9	0.212	0.408
Headache (%)	83	71	52	75	83	75	83	83		
Sleep problems (%)	92	83	78	79	83	79	92	83		
Paresthasias (%)	78	57	74	75	74	75	88	70		
Subjective joint swelling (%)	79	58	57	61	79	54	71	67		
Irritable bowel syndrome (%)	54	50	39	43	46	46	46	43		

<sup>a</sup> Range 0–10 (10 = worst score)

for two cases of mild and transient rash following the sulfur bath, no other side effects were reported.

## Discussion

The long-term treatment of FM remains problematic because the natural history of this condition appears to be one of continuous and unremitting pain. No one treatment strategy is effective in all patients. It is not surprising, then, that patients with FM frequently seek combined treatment modalities, including medications, physiotherapy, chiropractic, massage therapy, osteopathy, homeopathy, acupuncture, and naturopathy [13].

Balneotherapy may be regarded as a special form of physiotherapy, favorably affecting muscle tone, joint mobility, and pain intensity [14]. In the present study we attempted to evaluate the its effectiveness on patients with FM. All patients experienced relief in most FM-related symptoms (pain, fatigue, stiffness, and anxiety). In the treatment group that received sulfur baths, improvements lasted longer than in the control group. Patients also reported improved physical functioning lasting at least 3 months, especially in the treatment group.

Previously we have shown that balneotherapy in the Dead Sea (sulfur baths, mud packs, or a combination of both) was safe and effective in reducing objective and subjective indices of inflammation in rheumatoid and psoriatic arthritides [3,6]. However, to the best of our knowledge, this is the first study exploring the possible effect of balneotherapy on FM patients. Fitzcharles and

Esdaile [13] found no significant differences in either severity of symptoms or functional outcome in patients with FM, either with or without treatments by non-physician practitioners. The treatment modalities reviewed in their study included physiotherapy, massage therapy, osteopathy, homeopathy, chiropractic, acupuncture, and naturopathy.

The fact that even control patients in our study showed improvement, albeit less impressive and of shorter duration, is not totally unexpected. The temporary change in lifestyle, with a less stressful atmosphere and more rest, may explain the relief reported in the control group.

The mechanism by which spa treatment works is not fully understood. Immersion in spa water causes many physiological changes such as significant diuresis and natriuresis [15], hemodilution [16], and increased cardiac output without significant change in blood pressure [17, 18]. It is not clear whether these physiological changes have any influence on the disease process, but muscle tone, joint mobility, and pain intensity are clearly influenced by these hydromechanical and thermal stimuli.

The effects of balneotherapy on muscle tone, joint mobility, and pain intensity may affect peripheral mechanisms in the pathogenesis of FM that may account for the painful symptoms of FM, namely continuous muscle microtrauma, prolonged muscle tension, and ischemia. However, the effects of spa treatment on central mechanisms considered to be more important in FM are not clear and should be studied in the future.

Since the temperature of the water in the sulfur baths was 37°C, some of the beneficial results in the FM patients may be attributed to the effects of heat in addition to the chemical one. Future randomized controlled studies should include a control group of patients treated in hot water without sulfur. The management of FM continues to be disappointing. Thus, the availability of another effective and safe alternative such as spa therapy may broaden our treatment arsenal against this disorder.

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## References

1. Alarcon GS, Bradley LA (1998) Advances in the treatment of fibromyalgia: current status and future directions. *Am J Med Sci* 31:397–404
2. Pioro-Boisset M, Esdaile JM, Fitzcharles MA (1996) Alternative medicine use in fibromyalgia syndrome. *Arthritis Care Res* 9:13–17
3. Sukenik S, Buskila D, Neumann L, Kleiner-Baumgarten A, Zimlichman RS, Horowitz J (1990) Sulphur bath and mud pack treatment for rheumatoid arthritis at the Dead Sea area. *Ann Rheum Dis* 49:99–102
4. Sukenik S, Neumann L, Buskila D, Kleiner-Baumgarten A, Zimlichman S, Horowitz J (1990) Dead Sea bath salts for the treatment of rheumatoid arthritis. *Clin Exp Rheumatol* 8:353–357
5. Sukenik S, Buskila D, Neumann L, Kleiner-Baumgarten A (1990) Mud pack therapy in rheumatoid arthritis. *Clin Rheumatol* 11:243–247
6. Sukenik S, Giryas H, Halevy S, Neumann L, Flusser D, Buskila D (1990) Treatment of psoriatic arthritis at the Dead Sea. *J Rheumatol* 21:1305–1309
7. Wolfe F, Smythe HA, Yunus MB, Bennett RM, Bombardier C, Goldenberg DL et al (1990) The American College of Rheumatology 1990 criteria for the classification of fibromyalgia. *Arthritis Rheum* 33:160–172
8. Burckhardt CS, Clark SR, Bennett RM (1991) The Fibromyalgia Impact Questionnaire: development and validation. *J Rheumatol* 18:728–733
9. Buskila D, Neumann L (1996) Assessing functional disability and health status of women with fibromyalgia: validation of a Hebrew version of the Fibromyalgia Impact Questionnaire. *J Rheumatol* 23:903–906
10. Ramey DR, Raynauld JP, Fries JP (1992) The health assessment questionnaire 1992. Status and review. *Arthritis Care Res* 5:119–129
11. McCarty DI, Gatter RD, Steele AD (1968) A twenty pound dolorimeter for quantification of articular tenderness. *Arthritis Rheum* 11:696–697
12. Stata Corp (1997) Stata Statistical Software: Release 5.0. State Corporation, College Station, Tex., USA
13. Fitzcharles M, Esdaile JM (1997) Nonphysician practitioner treatments and fibromyalgia syndrome. *J Rheumatol* 24:937–940
14. Sukenik S, Shoenfeld Y (1996) The Dead Sea is alive. *Isr J Med Sci* 32 [Suppl]:S1–S3
15. O'Hare JP, Heywood A, Summerhayes C et al (1985) Observations on the effects of immersion in Bath spa water. *Br Med J* 291:1747–1751
16. O'Hare JP, Heywood A, Dodds P, Corral RJM, Dieppe P (1984) Water immersion in rheumatoid arthritis. (Abstract). *Br J Rheumatol* 23:117
17. Arborelius M, Ballidium U, Lilja B, Lungren C (1972) Hemoglobin changes in man during immersion head above water. *Aerospace Medicine* 43:592–598
18. Rennie D, Diprampero P, Carretelli P (1971) Effects of water immersion on cardiac output, heart rate and stroke volume of man at rest and during exercise. *Med Sport* 24:223–228