

Original article

The efficacy of balneotherapy and mud-pack therapy in patients with knee osteoarthritis

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Abstract

Objectives: Knee osteoarthritis (OA) is a common chronic degenerative disorder. There are various treatment modalities. This study was planned to investigate the efficacy of balneotherapy, mud-pack therapy in patients with knee OA.

Methods: A total of 80 patients with knee OA were included. Their ages ranged between 39–78. The patients were separated in to three groups. Group I ($n = 25$) received balneotherapy, group II ($n = 29$) received mud-pack therapy and group III ($n = 26$) was hot-pack therapy group. The therapies were applied for 20 min duration, once a day, five times per week and a total of 10 session. Patients were assessed according to pain, functional capacity and quality of life parameters. Pain was assessed by using Visual Analogue Scale (VAS) and Western Ontario McMaster Osteoarthritis Index (WOMAC) pain scale (0–4 likert scale). Functional capacity was assessed by using WOMAC functional capacity and WOMAC global index. Quality of life was evaluated by Nottingham Health Profile (NHP) self-administered questionnaire. Also physician's global assessment and the maximum distance that patient can walk without pain, were evaluated. The assessment parameters were evaluated before and after three months.

Results: There were statistically significant improvement in VAS and WOMAC pain scores in group I ($p < 0.001$), group II and III ($p < 0.05$). The WOMAC functional and global index also decreased in group I ($p < 0.05$), group II ($p < 0.001$) and hot-pack group ($p < 0.05$). Quality of life results were significantly improved in balneotherapy and mud-pack therapy groups ($p < 0.05$). No difference was observed in hot-pack therapy group ($p > 0.05$). The maximum distance was improved both in group I and II ($p < 0.05$) but not in group III. Also physician's global assessment was found to be improved in all groups ($p < 0.05$).

Conclusions: Balneotherapy and mud-pack therapy were effective in treating patients with knee OA.

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Keywords: Knee osteoarthritis; Balneotherapy; Mud-pack therapy

1. Introduction

Osteoarthritis (OA) is a degenerative joint disease which mostly affects the weight-bearing joints. Pain and limitation in range of motion are main symptoms in knee OA. It is often associated with impaired quality of life and disability. The goals of treatment are to relieve pain, to provide movement improvement and increase functional capacity. There are various treatment modalities including oral/intraarticular drugs,

exercise physical therapy and finally joint replacement surgery [1,2].

Balneotherapy has been used empirically in treating various musculoskeletal disorders since many years. The therapeutic value of thermal spring water has been linked to its composition, mineral concentration and the temperature. Several studies suggest a beneficial effect of balneotherapy on degenerative and inflammatory joint diseases. Also studies offer it, as an adjuvant therapy in the treatment of various chronic health conditions [3,4]. Mud-pack therapy is frequently used in daily rheumatologic practice. Mud-pack application alone or in combination with balneotherapy has been found to be effective on painful arthritic processes. It has been shown to induce

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anti-inflammatory activity and influence the anti-oxidant system in patients with OA [5].

Nguyen et al., noticed the significance of randomised controlled studies in spa therapy in patients with OA. They showed the efficacy of spa therapy not only in knee OA but also in lumbar spine and hip OA [6]. Despite few studies with different methodologies, their results show favourable effects on joint pain [6,7]. Recently there is an increase in scientific basis researches, however, no concept has been approved for both balneotherapy and mud-pack therapy yet.

In our country balneotherapy was applied in both modern and traditional way. The results of the studies indicated that nearly all kind of balneotherapy therapies were effective on a various rheumatic diseases in Turkey [8]. Afyon is a famous city with its hot springs. In our center the natural spring water flows at a temperature of 36–60 °C. It contains sodium 278 mgr/L, bicarbonate 677 mgr/L, as well as sulfate, calcium, magnesium, iron-aluminum cations, chlorine and metasilicate anions. Mud-packs do not have any bacteria, are not toxic and contain the same amount of anions and cations. In our city, it is easy to arrive at a spa center so patients sometimes prefer traditional methods. Therefore to determine the therapeutic value of bathing becomes a major problem. This study was planned to investigate the effectiveness of balneotherapy and mud-pack therapy in the treatment of knee OA.

2. Methods

Eighty patients (74 F/6 M) suffering from knee OA participated in the study. Diagnosis of OA was based on the criteria of American College of Rheumatology [9]. Patients having effusion in knees, previous knee arthroplasty, severe cardiovascular diseases and peripheral vascular diseases were excluded from the study. Also patients who had physical therapy program and intraarticular corticosteroid or hyaluronic acid injections within 6 months were excluded. After physical examination full blood count, erythrocyte sedimentation rate (ESR) and biochemical markers were evaluated. All patients received weight bearing anteroposterior and lateral X-rays. After the physician completed the assessment parameters, patients were directed to another physician in which the patients were allocated to the groups in order of their admittance Group I ($n = 25$) received balneotherapy. They had bathing in mineral water pools at 36 °C. Group II ($n = 29$) received mud-pack therapy. Group III ($n = 26$) had hot-pack application. Mud-packs and hot-packs were heated to 42 °C and applied

over knees for 20 min. Also the total duration of daily bathing was 20 min. All therapies were administered once a day and five times per week. They were treated as outpatients and participated the therapy programs for two weeks (10 sessions) under the supervision of a physiotherapist. During the therapy program, if needed they were allowed to take paracetamol in a maximum dose of 1500 mgr per day. At the end, patients were asked whether they continued the drug intake or not. The assessment parameters were measured before, at the end and 3 months after the therapy (2th and 12th week).

Patients were evaluated according to pain, functional capacity and quality of life parameters.

2.1. Pain

Pain was assessed by using a 10 cm Visual Analogue Scale (VAS) (0 no pain and 10 worst pain) and WOMAC pain scale (0–4 likert scale). VAS was used for measuring pain at night and while walking.

2.2. Physical function

Functional capacity was assessed by WOMAC functional capacity and WOMAC global index. They were evaluated by 0–4 likert scale. The functional capacity index included 17 questions and the scores ranged between 0–68. Global index included three categories which are pain (5 questions), stiffness (2 questions), and functional capacity (17 questions) and the scores ranged between 0–96 [10].

2.3. Quality of life

Quality of life was evaluated by the Turkish version of the Nottingham Health Profile (NHP). This is a self-administered questionnaire and includes six categories with 38 questions. These are energy (3 questions), pain (6 questions), emotional reactions (9 questions), sleep (5 questions), social isolation (5 questions) and physical mobility (8 questions) [11].

The maximum distance that patient can walk without pain was evaluated for all patients. Also physician's global assessment was assessed by using VAS scale. It measured the global well-being on average over the last week (higher scores indicate the worst results).

This study was approved by the University of Kocatepe Human Research Ethics Committee. Before treatment all

Table 1
General datas of all groups

	Balneotherapy group ($n = 25$)	Mud-pack group ($n = 25$)	Hot-pack group ($n = 25$)
Age (year)	55 ± 8.7 (41–78)	57.4 ± 9 (41–72)	59.6 ± 9.2 (45–78)
Gender (F/M)	23/2	22/3	24/1
Body mass index	30.2 ± 4.7 (21–42)	30.6 ± 4.1 (23–38)	30.4 ± 4.9 (22–43)
Disease duration (year)	6 ± 4.3 (1–15)	7 ± 4.9 (1–15)	6.4 ± 5.5 (1–20)
Grade 1 OA	11	14	11
Grade 2 OA	10	9	11
Grade 3 OA	4	2	3

Table 2
The changes in physician's global assessment results before, at the end and after 3 months of the therapy in all groups

	Physician's global assessment		
	Group I	Group II	Group III
Week 0	3.8 ± 1.8	4.0 ± 2.3	4.4 ± 1.7
Week 2	2.6 ± 1.9	3.0 ± 2.4	3.4 ± 1.8
<i>p</i>	0.000**	0.006*	0.018*
Week 12	3.1 ± 1.9	3.3 ± 2.1	3.5 ± 1.9
<i>p</i>	0.005*	0.027*	0.050*

Data are expressed as means ± standard deviation. **p* < 0.05, ***p* < 0.001.

participants were informed of the trial and gave written informed consent.

2.4. Statistical analysis

The means and standard deviations were given as descriptive statistics. For determining the difference before and after treatment for all groups, non-parametric Friedman test was used. In order to compare the difference between all groups Kruskal–Wallis test was used. All analysis were performed by using the SPSS for Windows 10.0 software program.

3. Results

General data of the patients are shown in Table 1. Seventy-five patients completed the study. Four patients from mud-pack therapy and one patient from hot-pack group were dropped out because of personal problems. Therefore 25 patients in each group were statistically analyzed.

The results of full blood count ESR and biochemical markers were in normal ranges for all groups. There was no difference in paracetamol consumption between groups. At the beginning of the study no statistically differences of the scores in WOMAC pain, functional and global index were observed.

In balneotherapy group there was a statistically significant difference in physician's global assessment after the therapy (*p* < 0.001) and after 3 months (*p* < 0.05). Also a significant improvement was observed both in mud-pack and hot-pack therapy groups (*p* < 0.05). The results are shown in Table 2.

Table 3
Comparison of the painless walking distance in patients in different treatment groups and within the groups at 2nd and 12th weeks

	Balneotherapy group (<i>n</i> = 25)	Mud-pack group (<i>n</i> = 25)	Hot-pack group (<i>n</i> = 25)	<i>p</i> value
Painless Walking Distance (m) Before treatment	719.6 ± 577.4	442.84 ± 426.4	668.8 ± 1085.7	0.15
Painless Walking Distance (m) After treatment	988.4 ± 748.4	490.8 ± 507.7	716.4 ± 1077.7	0.037*
<i>p</i>	0.007*	0.035*	0.414	
Painless Walking Distance (m) In Follow-up (three months)	1064.8 ± 1075.2	454.44 ± 403.2	740.8 ± 1096.1	0.039*
<i>p</i>	0.025*	0.166	0.096	

**p* < 0.05.

Initially there was no significant difference regarding painless walking distance between the patients in different treatment groups. But, after the treatment and in follow-up evaluation, it was significantly different between the groups (*p* < 0.05). The maximum distance that patient can walk without pain was improved in group I and II (*p* < 0.05) but not in hot-pack therapy group. However during follow up, this improvement was still significant only in balneotherapy group (*p* < 0.05) (Table 3).

3.1. Pain

At the end of the therapy and after three months, there was a decrease in WOMAC pain and VAS (walking) scores in group I (*p* < 0.001). In group II, pain scores were statistically decreased after 2 weeks (*p* < 0.001) and three months (*p* < 0.05). Also WOMAC pain (*p* < 0.001) and VAS (walking) (*p* < 0.05) scores were found to be decreased in hot-pack therapy group. However, this improvement did not continue until three months (*p* > 0.05). There was no improvement in VAS (at rest) scores in any group (*p* > 0.05) (Table 4). Neither WOMAC pain nor VAS (walking) scores were differed significantly between the groups, before and after treatment and in follow-up (*p* > 0.05).

3.2. Physical function

The WOMAC functional and global index also decreased in group I (*p* < 0.05), group II (*p* < 0.001) and hot-pack therapy group (*p* < 0.05). After 3 months this improvement was still significant in both balneotherapy and mud-pack groups but not in hot-pack therapy group. The results were shown in Figs. 1 and 2. However no significant difference was observed within the groups (*p* > 0.05).

3.3. Quality of life

The results of energy, emotional reactions and social isolation scores showed no statistical difference between all groups. In balneotherapy and mud-pack groups there were statistically improvement in pain, physical mobility and sleep scores (*p* < 0.05). This improvement remains to the end of the follow-up period in both groups (*p* < 0.05). However, no

Table 4
The results of VAS(walking) and WOMAC pain scores of the patients

	WOMAC pain				VAS (walking)			
	Group I	Group II	Group III	<i>p</i>	Group I	Group II	Group III	<i>p</i>
Week 0	9.1 ± 3.6	11.0 ± 3.3	9.9 ± 4.4	0.216	4.8 ± 2.6	5.0 ± 2.3	4 ± 1.9	0.222
Week 2	6.8 ± 5.3	7.7 ± 4.1	7.8 ± 4.0	0.716	3.2 ± 2.5	4.0 ± 2.4	3.8 ± 2.7	0.401
<i>p</i>	0.000**	0.000**	0.000**		0.000**	0.000**	0.015*	
Week 12	7.5 ± 3.9	9.0 ± 3.6	9.4 ± 4.5	0.227	4.0 ± 2.1	4.4 ± 2.3	4.3 ± 2.6	0.836
<i>p</i>	0.000**	0.003*	0.285		0.000**	0.045*	0.157	

Data are expressed as means ± standard deviation. **p* < 0.05, ***p* < 0.001.

difference was observed in hot-pack therapy group (*p* > 0.05). The results of NHP are shown in Table 5.

4. Discussion

Balneotherapy has been widely used in the treatment of various musculoskeletal disorders for centuries. Although it has been reported to be effective in the treatment of osteoarthritis, still there is not a common concept about its mechanism. Several factors may play a role in thermal action. It is also not clear that whether the effect of balneotherapy depends on water temperature or the addition of minerals to the water.

The positive effects of Dead Sea baths were demonstrated in the treatment of both non-inflammatory and inflammatory diseases [3,12] Studies showed the efficacy of balneotherapy on low back pain and fibromyalgia [13,14]. It also provides an improvement in general well-being and quality of life in chronic health conditions [13,15]. Guillemin et al., observed an improvement in quality of life in both lower limb OA and low back pain after spa therapy [16]. We observed that there was an improvement in NHP scores in both balneotherapy and mud-pack therapy groups but not in hot-pack therapy group. This improvement was valuable especially in pain, physical mobility and sleep categories. In our study all groups

were treated in the same therapy complex, however balneotherapy and mud-pack therapy groups were treated in hydrotherapy unit and control group underwent hot-pack application in physical therapy unit. Although the patients were outpatiently treated, this difference may depend on the influence of the vacation in a resort area, as the hot-pack therapy group underwent hot-pack application in physical therapy unit at the hospital.

Recent studies reported that balneotherapy was effective on chronic pain management [17]. It is well known that pain is a major symptom in OA. In a double blind, controlled, follow-up study, patients with knee OA had balneotherapy with thermal water or tap water. Patients had daily bathing for 30 min during 15 days treatment period. They reported that thermal treatment was found to be effective in reducing pain and increasing ambulation even after three months [18]. Tishler et al., applied balneotherapy (30 min daily) in knee OA patients intermittently (once weekly) for consecutive six weeks. They found out an improvement in pain and functional capacity which were sustained until week ten [19]. A 6 month follow-up study indicated the prolonged beneficial effect of 3 weeks spa therapy in OA patients [6]. In our study total duration of

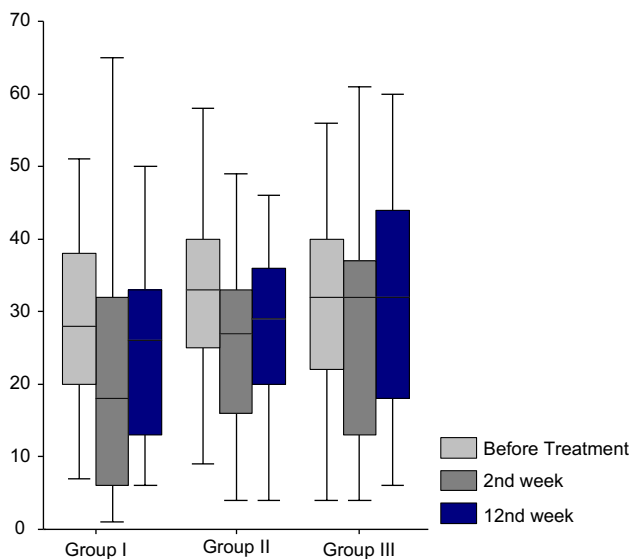


Fig. 1. The results of WOMAC functional index initially, after 2 weeks and at the end of 3 months (12 weeks) for all groups.

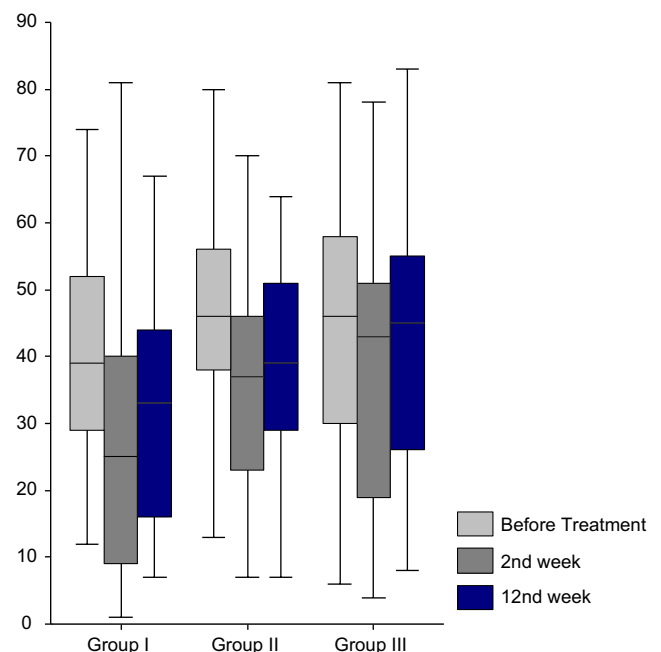


Fig. 2. Baseline and follow-up results of WOMAC global index for all groups.

Table 5
Baseline and final results of the six categories of NHP for all groups

NHP	Group I			Group II			Group III		
	(n = 25)			(n = 25)			(n = 25)		
	BT	AT	p	BT	AT	p	BT	AT	p
Pain	47.0 ± 23.4	42.3 ± 23.5	0.046*	54.5 ± 21.9	46.7 ± 20.3	0.024*	54.0 ± 24.9	51.6 ± 24.2	0.260
Energy	61.3 ± 31.4	55.9 ± 39.3	0.104	66.6 ± 27.2	57.9 ± 28.8	0.135	54.6 ± 37.1	47.8 ± 42.4	0.056
Physical	70.5 ± 26.4	61.5 ± 28.6	0.009*	77.6 ± 23.0	63.2 ± 29.7	0.002*	72.0 ± 25.3	65.0 ± 31.5	0.058
Mobility									
Emotional	42.1 ± 32.8	35.9 ± 33.2	0.080	45.5 ± 28.3	34.3 ± 26.7	0.125	41.3 ± 34.9	33.3 ± 33.1	0.054
Reactions									
Sleep	36.9 ± 34.7	28.5 ± 31.3	0.007*	40.3 ± 32.2	27.6 ± 33.0	0.024*	49.7 ± 35.2	40.4 ± 36.7	0.060
Social	14.3 ± 24.8	13.8 ± 25.0	0.695	28.8 ± 27.1	21.5 ± 21.4	0.125	25.6 ± 32.4	19.1 ± 25.9	0.090
Isolation									

Data are expressed as means ± standard deviation. BT: Before treatment, AT: After treatment, * $p < 0.05$.

treatment was 20 min once a day, a total of 10 sessions in two weeks. We observed the positive effects of balneotherapy and mud-pack therapy even after three months of the therapy. The results of daily bathing for 30 min were satisfying in the treatment of inflammatory diseases [12]. Although our treatment period seems to be lower than previous studies, there is no difference in its beneficial effect. Furthermore it is clear that the treatment regimen shows variation in different studies and no standard treatment protocol is accepted yet.

It was indicated that after balneotherapy there was a reduction in hospital admission and absence from work, associated with an improvement in socio-economic parameters. Also there was a decrease in using additional treatments such as physical and pharmacological therapies [20].

Mud-pack application is another treatment choice for OA patients. Studies have shown that mud therapy affects several biochemical markers and has anti-rheumatic actions. It has protective effect on cartilage homeostasis [21,22]. It has a role in the production of proinflammatory cytokines and in modulating inflammatory reactions. Mud-pack has a therapeutic activity due to both antiinflammatory component and thermal effect [23]. With mud-pack therapy we observed an improvement in pain and functional capacity and quality of life parameters.

Wigler et al., evaluated the effects of spa therapy on patients with gonarthrosis. They applied three different treatment regimens including balneotherapy with mineral mud packs, balneotherapy with mineral free mud packs and tap water with mineral free mud packs. They observed global improvement in all three regimens [3].

Mostly superficial heating therapy includes paraffin baths, hot-packs, mud baths, balneotherapy and mineral waters. The common action mechanism is to increase pain threshold by affecting sensory and muscle nerve endings. Beta-endorphin releasing and washing out the pain mediators by peripheral vasodilatation also play a role in producing analgesia and sedation [24]. Furthermore the relaxing influence on muscles and ligaments are important factors. Also the complex interaction between central nervous system cytokines and endorphin system may play a role in reducing pain [17].

Finally because of methodological flaws, there are not sufficient data about the efficacy of spa therapy on osteoarthritis.

This study supports the beneficial effects of balneotherapy and mud pack application on pain management, functional capacity and quality of life parameters. Also they had long lasting affects during follow-up period (3 months). It may be an alternative method in treatment of knee OA, especially with high-risk of drug-related patients.

References

- [1] Buckwalter JA, Stanish WD, Rosier RN, Schenck Jr RC, Dennis DA, Coutts RD. The increasing need for non-operative treatment of patients with osteoarthritis. *Clin Orthop* 2001;385:36–45.
- [2] Pavelka K. Treatment of pain in osteoarthritis. *Europ J Pain* 2000;4:211–3.
- [3] Wigler I, Elkayam O, Paran D, Yaron M. Spa therapy for gonarthrosis: a retrospective study. *Rheumatol Int* 1995;15:65–6.
- [4] Franke A, Reiner L, Pratzel HG, Franke T, Resch KL. Long-term efficacy of radon spa therapy in rheumatoid arthritis—a randomized, sham-controlled study and follow-up. *Rheumatology* 2000;39:894–902.
- [5] Bellometti S, Giannini S, Sartori L, Crepaldi G. Cytokine levels in osteoarthritis patients undergoing mud bath therapy. *Int J Clin Pharmacol Res* 1997;17:149–53.
- [6] Nguyen M, Revel M, Dougados M. Prolonged effects of 3 week therapy in spa resort on lumbar spine, knee and hip osteoarthritis: follow-up after 6 months. A randomized controlled trial. *Br J Rheumatol* 1997;36:77–81.
- [7] Karagulle MZ, Karagulle M. Balneotherapy and spa therapy of rheumatic diseases in Turkey: a systematic review. *Forsch Komplementarmed Klass Naturheilkd* 2004;11:33–41.
- [8] Forrester R. Magnitude and duration of the effects of two spa therapy courses on knee and hip osteoarthritis: an open prospective study in 51 consecutive patients. *Joint Bone Spine* 2000;67:262–3.
- [9] Hochberg MC, Altman RD, Brandt KD, Clark BM, Dieppe PA, Graiffin MR, et al. Guidelines for the medical management of osteoarthritis. *Arthritis Rheum* 1995;38:1541–6.
- [10] Bellamy N, Buchanan WW, Goldsmith CH, Campbell J. Validation study of WOMAC: a health status instrument for measuring clinically-important patient-relevant outcomes following total hip or knee arthroplasty in osteoarthritis. *J Orthop Rheumatol* 1988;1:95–108.
- [11] Kucukdeveci AA, McKenna SP, Kutlay S, Gursel Y, Whalley D, Arasil T. The development of and physiometric assessment of the Turkish version of the Nottingham Health Profile. *Int J Rehabil Res* 2000;23:31–8.
- [12] Elkayam O, Ophir J, Brener S, Paran D, Wigler I, Efron D, et al. Immediate and delayed effects of treatment at the Dead Sea in patients with psoriatic arthritis. *Rheumatol Int* 2000;19:77–82.
- [13] Constant F, Guillemin F, Collin JF, Boulange M. Use of spa therapy to improve the quality of life of chronic low back pain patients. *Med Care* 1998;36:1309–14.

- [14] Altan L, Bingol U, Aykac M, Koc Z, Yurtkuran M. Investigation of the effects of pool-based exercise on fibromyalgia syndrome. *Rheumatol Int* 2004 Sep;24:272–7.
- [15] Strauss-Blasche G, Ekmekcioğlu C, Klammer N, Marktl W. The change of well-being associated with spa therapy. *Forsch Komplementarmed Klass Naturheilkd* 2000;7:269–74.
- [16] Guillemin F, Virion JM, Escudier P, De Talance N, Weryha G. Effects of osteoarthritis of spa therapy at Bourbonne-les-Bains. *Joint Bone Spine* 2001;68:499–503.
- [17] Bender T, Karagulle Z, Balint GP, Gutenbrunner C, Balint PV, Sukenik S. Hydrotherapy, balneotherapy and spa treatment in pain management. *Rheumatol Int* 2005;25:220–4.
- [18] Kovacs I, Bender T. The therapeutic effects of Cserkeszolo thermal water in osteoarthritis of the knee: a double blind, controlled, follow-up study. *Rheumatol Int* 2002;21:218–21.
- [19] Tishler M, Rosenberg O, Levy O, Elias I, Amit-Vazina M. The effect of balneotherapy on osteoarthritis. Is an intermittent regimen effective? *Eur J Internal Med* 2004;15:93–6.
- [20] Fioravanti A, Valenti M, Altobelli E, Di Orio F, Nappi G, Crisanti A, et al. Clinical efficacy and cost-effectiveness evidence of spa therapy in osteoarthritis. The results of “Naiade” Italian Project. *Panminerva Med* 2003;45:211–7.
- [21] Bellometti S, Galzigna L, Richelmi P, Gregotti C, Berte F. Both serum receptors of tumor necrosis factor are influenced by mud pack treatment in osteoarthrotic patients. *Int J Tissue React* 2002;24: 57–64.
- [22] Bellometti S, Poletto M, Gregotti C, Richelmi P, Berte F. Mud bath therapy influences nitric oxide, myeloperoxidase and glutathione peroxidase serum levels in arthritic patients. *Int J Clin Pharmacol Res* 2000;20: 69–80.
- [23] Bellometti S, Cecchettin M, Galzigna L. Mud pack therapy in osteoarthritis, changes in serum levels of chondrocyte markers. *Clin Chim Acta* 1997;268:101–6.
- [24] Curkovic B, Vitulic V, Babic-Naglic D, Durrigl T. The influence of heat and cold on the pain threshold in rheumatoid arthritis. *Z Rheumatol* 1993;52:289–91.