THE ROLE OF NATURAL BIOTHERAPEUTIC FACTORS IN PAIN AND FUNCTIONAL MANAGEMENT OF KNEE OSTEOARTHRITIS

MADALINA GABRIELA ILIESCU 1,2*, ELENA VALENTINA IONESCU 1,2, IRINA TICA 1,3*, MARIUS-DRAGOS PRAZARU 3, FLORINA LIGIA POPA 4, MARIUS NICOLAE POPESCU 5, MIHAI BERTEANU 5, LASZLO IRSAY 6*, VIORELA MIHAELA CIORTEA 6, FELIX VOINEA 1,3, BOGDAN OBADA 1,3, LUCIAN PETCU 1, ANDRA IULIA SUCEVEANU 1,3

1Faculty of Medicine, “Ovidius” University of Constanța, 1 University Alley, Campus – Corp B, 900470 Constanța, Romania
2Balneal and Rehabilitation Sanatorium Techirghiol, 34–40 Dr. Victor Clăinescu Street, 906100, Techirghiol, Romania
3County Emergency Teaching Hospital of Constanța, Tomis Boulevard, 900591 Constanța, Romania
4Physical Medicine and Rehabilitation Department, “Lucian Blaga” University of Sibiu, Faculty of Medicine, Academic Emergency Hospital of Sibiu, Victoriei Boulevard, 550024, Sibiu, Romania
5Department of Physical and Rehabilitation Medicine - “Elias” Emergency University Hospital, “Carol Davila” University of Medicine and Pharmacy, 8 Eroșii Sanitari Boulevard, 050474, Bucharest, Romania
6“Jilava” University of Medicine and Pharmacy Cluj-Napoca, Department of Rehabilitation, Clinical Rehabilitation Hospital Cluj-Napoca, 8 Victor Babeș Street, 400000, Cluj-Napoca, Romania

*corresponding author: irinatica@gmail.com
*Authors with equal contribution.

Abstract

Knee osteoarthritis (OA) represents one of the most frequently treated pathology within the rehabilitation departments all over the world; it involves people over 40, mostly overweight subjects. Our present study, performed on 65 patients diagnosed with knee OA, treated with physiotherapy, hydrotherapy and peloidotherapy in the Balneal Sanatorium of Techirghiol, Romania, tries to demonstrate the importance of the natural biotherapeutic factors on the pain and knee functioning in this pathologic condition. All the patients were assessed using the Visual Analogue Scale (VAS) and Functional Independence Measures (FIM), prior and after the treatment. Exclusion criteria were the major pathologic conditions that represent contraindications for physical therapies, and associated neurologic and post-traumatic conditions, also. The results demonstrate the reduction, with almost 50%, of the initial pain intensity score and the improvement of general functioning with almost 35%. So, we conclude that natural therapeutic factors can represent a safe non-pharmacological therapeutic way for improving the functionality of these patients, directly related with pain intensity, with low cost and high accessibility.

Rezumat

Osteoartritica genunchiului (OA) reprezintă una dintre cele mai frecvent tratate patologii din cadrul departamentelor de reabilitare din întreaga lume, care implică persoane de peste 40 de ani, în principal subiecții supraponderali. Prezentul studiu, efectuat pe 65 de pacienți diagnosticăți cu OA la genunchi, tratați cu fizioterapie, hidroterapie și peloidoterapie în Sanatoriul Balnear și de Recuperare din Techirghiol, România, încercă să demonstreze importanța factorilor bioterapeutici naturali asupra durerii și funcționării genunchiului în această stare patologică. Toți pacienții au fost evaluați utilizând scala analogică vizuală (VAS) și măsurarea independenței funcționale (FIM), înainte și după tratament. Criteriile de exclusie au fost principalele condiții patologice care reprezintă contraindicații pentru terapiile fizice, precum și condițiile neurologice și post-traumatice asociate. Rezultatele demonstrează reducerea, cu aproape 50%, a scării inițiale a intensității durerii și îmbunătățirea funcționării generale cu aproape 35%. Deci, concluzionăm că factorii terapeutici naturali pot reprezenta o modalitate terapeutică sigură non-farmacologică de îmbunătățire a simptomatologiei acestor pacienți, direct legată de intensitatea durerii, cu costuri reduse și accesibilitate ridicată.

Keywords: knee osteoarthritis, physiotherapy, balneotherapy

Introduction

Over the past decades, balneotherapy became an important medical treatment for several diseases including chronic musculoskeletal diseases such as knee osteoarthritis (OA), one of the most frequently treated pathology from our balneal area [1, 5]. The beneficial effect of balneotherapy is a result of mechanical, thermal and chemical effects of the natural factors used for treatment, in our case salt water and sapropelic mud from Techirghiol lake [18, 21]. Techirghiol Lake is located in Romania, in Dobrogea County, 16 km from Constanța, near Eforie Nord, on Lake Techirghiol shore, in a region with a mean
altitude of about 200 - 300 m, situated between the lower Danube River and the Black Sea. The lake is within a temperate continental climatic area with an important influence of the sea. The depression occupied by the lake was formed as fluvial-maritime lagoon during the last glacial periods [17]. The lake’s water has important peculiarities due to the variable concentrations of salt, ranging between insignificant salinity and up to 60 g/L, even 85 g/L. The water’s colour is greenish due to the numerous microorganisms and algae [17]. Despite that water can be a vehicle for transmitting different germs [8, 10, 11, 27], the salty water and the sapropelic mud of Techirghiol lake have a high curative importance [18] with proved therapeutic benefits [6, 24]. OA is a multifactorial degenerative joint disease characterized by profound damage of the articular cartilage, changes in the subchondral bone, formation of osteophytes and synovial inflammation. Although, it is the most common rheumatic disease, its etiology is largely unknown. Age, obesity and sex are considered significant risk factors. In OA, although frequently described as a non-inflammatory disease, inflammation is recognized for its contribution to symptoms and its evolution [18, 22]. The imbalance between the inflammatory response and metabolic regulation, two essential mechanisms involved in cellular homeostasis represents the background of several chronic diseases [3, 28]. Inflammation can be the main event in OA or may occur secondary to other aspects of the disease, such as biochemical changes inside the cartilage [9, 18].

As there is still no pathogenic treatment for OA, it is a natural interest in using a therapeutic method of impressive longevity (the mud treatment), with recognized anti-inflammatory therapeutic effects, even if not validated by rigorous scientific studies [12, 20]. The complexity of the biochemical composition, the rich microbial flora, the inter-relationships between its components, make the detection of mud’s physiological and therapeutic effects and the mechanisms by which they are produced, difficult to identify [17]. Techirghiol sapropelic mud has proven its effectiveness in a wide range of pathological conditions in rheumatology, dermatology, endocrinology, neurology etc. [13]. Despite the spectacular development of the minimally invasive surgical techniques, providing a reduction of postoperative pain and of the postoperative complications [29], knee OA represents one of chronic diseases that needs long periods of pain medication and physical and rehabilitation treatments. That is why natural treatments remain one of the most frequent options, with large benefits and little contraindications [30]. Besides pain, functioning is important for these patients, for the improvement of their quality of life [20, 29]. Many other degenerative pathologies, mostly of the musculoskeletal system, have indications for natural treatments using biotherapeutic factors [12, 24].

Materials and Methods

Our study was performed on 65 patients, diagnosed with bilateral primitive knee OA (Kellgren-Lawrence III stage), treated with physiotherapy, hydrotherapy and peloidotherapy for 2 weeks (about ten days) in the Balneal Sanatorium of Techirghiol, Romania, indoor program. All the patients were assessed using the Visual Analogue Scale (VAS) and the Functional Independence Measures (FIM), prior and after the treatment. VAS indicates the intensity of pain, 0 means no pain, 10 indicates the worst pain ever. FIM represents one of the most frequent measurement systems for disability, based on the International Classification of Impairment, Disabilities and Handicaps used for rehabilitation medical system and indicates how much assistance is required for the individual to carry out activities of daily living. The FIM assesses areas of motor function (self-care, transfers, locomotion) and it has been tested before, also for use in patients with degenerative conditions. All the evaluated patients signed the consent for the study. Exclusion criteria were the major pathologic conditions that represent contraindications for physical therapies, and also associated neurologic and post-traumatic conditions. The physiotherapy program consisted of: electrotherapy (laser-therapy and ultrasound), massage and kinetotherapy, among hydrotherapy techniques: hydrokinetic bath [7, 19] in salt lake water in thermoneutral temperature (36 - 37°C), and all patients did warm peloidotherapy in local or general applications, also thermoneutral (37 - 38°C). VAS and FIM were measured in day one (VAS 1, FIM 1), and after ten days (VAS 10, FIM 10) of therapeutic procedures.

Statistical analysis

The final scores were statistically analysed using IBM SPSS Statistics 23. The procedures used were: descriptive statistics (for characterizing discrete and continuous variables defined at the database level), graphs, parametric statistical tests (T-test for comparing the average of two independent samples), non-parametric statistical tests - Association χ2 test the link between two categorical variables), the χ2 concordance test, the z test for comparing two proportions, the Mann-Whitney test (used to test the difference between two independent groups), the median test (used to verify the equality of two medians), the Wilcoxon test (used to test the difference between two dependent groups). In all cases the chosen significance level was α = 0.05 [25, 26].

Results and Discussion

Demographic characteristics of our study group, 31 male and 34 female, are represented in Table I. Most of the patients come from urban areas (86.15%); almost half of them retired (37), and 24 employees. Regarding the occupation, we assessed that female
were mostly retired or without a job, while males were professionally active in about 54% of the cases. Regarding age intervals, 36 patients (19 females) were between 60 - 70 years old (Table I). According to Independent Samples Test it was no significant difference regarding age distribution among men and women groups ($t = 0.819$, $df = 63$, $p = 0.416 > \alpha = 0.05$).

| Number | %   | Occupation | Age groups |
|--------|-----|------------|------------|
| Male   | 31  | 47.69%     | 40-50 years | 50-60 years | 60-70 years |
| Female | 34  | 52.31%     | 11         | 20         | 3           | 7          | 8          | 19         |

Table I

Demographic characteristics of the patients within the study

Of major importance in the present study is the analogue visual scale (VAS) for pain. We noticed an average of VAS 1 median value of 7 in both male and female groups, with a symmetry of data distribution for both the female and the male group, with no aberrant distributions and with no significant difference between male and female groups ($p = 0.284$, $\alpha = 0.05$). At discharge, VAS 10 median values were: 3 in the male group and 4 in the female group, again with a symmetry of data distribution for both the female and the male group, with no aberrant distributions and with no significant difference between male and female groups ($p = 0.307$, $\alpha = 0.05$).

According to the statistical analysis of FIM we observe a median of FIM 1 values at admission of 18 in the male group and 19 in the female group, with symmetry of the data distribution for both the female and the male group and no aberrant distributions, but the median values had significant differences ($p = 0.000$, $\alpha = 0.05$) between sexes. According to the statistical analysis of FIM 10 at discharge we noticed a median of FIM 10 values of 24 in both groups, with symmetry of the data distribution for both the female and the male group and with NO significant differences between the median values of the male vs. female group ($p = 0.096$, $\alpha = 0.05$).

Analysing comparatively the values obtained for VAS and FIM, at admission and discharge, we observed that the median VAS decreased from 7 to 3, the minimum from 5 to 1, and the maximum from 9 to 5, and the Interquartile Range of at 2 to 1, while the median FIM increased from 19 to 24, the minimum from 15 to 20, the maximum from 21 to 29, and the Interquartile Range from 1.50 to 3. Variation of the mean values and standard deviation of VAS score in day 1 compared with day 10 are represented in Figure 1, and as it is shown, the pain scores decreased statistically significant, $p < 0.005$ for all the patients after the applied treatment. Variation of the mean values and standard deviation of FIM scores in day 1 compared with day 10 are represented in Figure 2, and as it is shown, the values decreased for all patients, after applying the treatment, at a statistical significance level, $p < 0.005$.

According to literature, scientific progress in medicine regarding the understanding of the pathogenic mechanisms of osteoarthritis has been and will be a permanent challenge [18]. On the other hand, it is known that diseases appeared along with mankind who instinctively learned to relieve its suffering with the help of the surrounding elements: water, heat and plants. In this study, we aimed to demonstrate the clinically beneficial effect of applications of natural factors in degenerative knee pathology [17, 21]. From a demographic point of view, the analysed group consisted of 52% female, 48% male, mainly from urban areas (86%), and in terms of age, the interval 60 - 70 predominated for both sexes, most of them.

![Figure 1](image1.png)

Figure 1.

Representation of VAS scores with significant difference between day 1 (7.23) and day 10 (3.35)

![Figure 2](image2.png)

Figure 2.

Representation of FIM values with significant difference between day 1 (18.71) and day 10 (24.18)
being retired. The studied group is in line with the general trend of addressability for spa treatments for degenerative diseases [30]. In the study, we quantified VAS for pain [14, 16, 20]. VAS is a psychometric response scale that can be used in questionnaires. It is a measuring instrument for subjective characteristics or attitudes that cannot be measured directly. Respondents specify their level by a statement indicating a position along a solid line between two points. VAS was performed both at the time of inclusion in the research project, day 1, and after 10 days of treatment. We found a decrease in the mean value of VAS (p < 0.05) with statistical significance, which means that the treatment applied was effective in short term. Probably due to the fact that the biological effects of mud-bath therapy in osteoarthritis are secondary to thermal and chemical stimuli, an increase in the temperature of the skin, of the subcutaneous tissue and of the muscles occurs, with a decrease of the muscular tonus. Hyperaemia at periarticular sites (capsules, ligaments, and tendon insertions) caused by heat stimulation with thermal mud can contribute to the removal of inflammatory cytokines and chemokines, thus reducing pain, as VAS measurement revealed [12, 23]. Patients were evaluated functionally also, by the FIM scale [15, 16, 22, 31]. The Functional Independence Measure (FIM) is an 18-item measurement tool that explores an individual’s physical, psychological and social function. The tool is used to assess a patient’s level of disability as well as a change in patient status in response to rehabilitation or medical intervention. The FIM uses the level of assistance an individual needs to grade its functional status from total independence to total assistance. The FIM is used by healthcare practitioners to assess and grade the functional status of a person based on the required level of assistance. FIM scores range from 1 to 7. The grading categories range from “total assistance = 1” to “complete independence = 7”. Irrespective of the use of any assisting device, the person is considered completely independent. Scores falling below 6 require another person for supervision or assistance. Interesting tasks for OA that are evaluated using the FIM include transfers, locomotion, as well as the following six care activities: feeding, grooming, bathing, upper body dressing, lower body dressing, toileting. The FIM measures what an individual can perform and not, what that person could do under certain circumstances [15]. Our results revealed a significant increase in FIM values, p < 0.05. The data obtained is in accordance with existing studies and meta-analyses in international databases [23]. In patients with knee joint OA in whom natural factors were applied (mineral sodium chloride baths and mud applications), immediately after the treatment and 1 month after treatment, anthropometric data significantly improved, pain intensity and joint stiffness decreased, physical activity increased compared to the control group [30]. Many other studies demonstrate the effectiveness of natural therapeutic factors on many pathologies [2, 5, 13], and, the actual pandemic times need new potential vectors from natural field to increase the nonspecific immunity and also for functional rehabilitation [4].

Conclusions

The pain in patients with knee osteoarthritis was significantly ameliorated after 10 days of treatment, as the statistical analysis revealed. This proves once again that functional rehabilitation treatment is one of the main therapeutic methods in this condition. The functioning score of these categories of patients, in order to participate in various activities, was significantly improved after the application of rehabilitation therapies that included natural therapeutic factors in the area of Lake Techirghiol. The adherence to treatment of these categories of patients is significantly high for the above mentioned reasons, natural therapies being well accepted and with great results. The natural bio-therapeutic factors remain an effective nonpharmacological therapeutic method that may improve the functionality of these patients, directly related with pain intensity, and with low cost and high accessibility.

Conflict of interest

The authors declare no conflict of interest.

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