Therapeutic Effects of the Geothermal Water in the Felix Spa, Romania

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INTRODUCTION
Of the about 160 thermal spas in Romania, 23 are of national importance and also internationally recognized for the therapeutic effect of their geothermal waters. Felix Spa is probably the best known of them, and definitely the largest. It belongs to the largest geothermal area of the country.

It is located 10 km SE from the City of Oradea in Bihor County, the northwestern part of Romania. It is at an altitude of 140 m in a hilly zone at the edge of a beech and oak forest. The climate is mild both in winter and summer. Yearly average temperature is +10°C (average temperature is −2°C in January and +20.4°C in August). There is little rainfall and low winds. Since the weather is quite stable, people’s acclimatization raises no problem.

The existence and development of Felix Spa is bound directly to the natural thermal springs in the area, and to the positive effects of the geothermal waters on the health, well known and testified to through the centuries. One of the first known documents certifying that the waters near Oradea were well known and appreciated in Europe dates from 1405 in a letter written by Pope Innocent the VII. Many suppositions were made about the name Felix Spa. Some researchers thought the happiness of recovered patients has given the name, others associated the name of the spa with that of its first superintendent, Helcher Felix.

THE FELIX SPA GEOTHERMAL RESERVOIR
In the classification of mineral waters, the thermonineral waters from Felix and 1 Mai Spas, belong to the akratotherme group of waters. They have a total mineral concentration \( \mu \) under 1g and a temperature at the spring between 32°C for “Felix Spring” and 49°C for “Balint Spring.”

The three geothermal reservoirs identified in the Oradea area are quite different from others located in the Pannonian Basin, of which they are a part, or in other sedimentary basins. The main reservoir is almost entirely situated within the city limits of Oradea. The second one is in Felix Spa, 10 km SE from Oradea, and the third near the village of Bors, 6 km NW from Oradea.

The Oradea reservoir is located in fractured Triassic limestones and dolomites about 2,200 to 3,200 m deep, and the Felix Spa reservoir is located in two layers of fractured Cretaceous limestones, 45 to 175 and 200 to 750 m deep. The extraction history shows that both are open and hydrodynamically connected reservoirs. The interference test of 1984 (Plavita and Cohut, 1990) showed a natural recharge of about 300 to 350 l/s originating in the Apuseni Mountains about 80 km east of Oradea. By the 14C method, the geothermal water from the Oradea and Felix Spa reservoirs was found to be about 20,000 years old. In the Oradea aquifer, the temperature decreases from NW to the SE and continues to decrease into the Felix Spa aquifer. The geothermal boreholes and natural hot springs in Felix Spa have surface temperatures ranging from 35 to 55°C.

The first analysis of the waters, kept among archive documents in Oradea, was elaborated by Dr. Francisc Grebb from Oradea, in 1731.

In 1777, in the work “Therme Varadiensis,” the medical value of the geothermal waters in Felix Spa was certified.

Many researchers since have studied the chemical composition of these geothermal waters. Among them are Dr. Dick and professor Dr. Gh. Spacu from the Analytic Chemistry Institute of Cluj Napoca.

At the World Exhibition in 1896, the geothermal waters from this spa, known by then as “Bishop’s Baths,” were awarded the gold medal and the diploma of honor.

The chemical composition of the geothermal fluid in the Oradea and Felix Spa reservoirs is basically the same. Atomic spectrometric methods were used to investigate the chemical composition of these waters at the Stable Isotopes Institute in Cluj Napoca, by the chemist Bindea.

In examinations made by the labs of Physical Medicine and the Balneo-Climatology Institute in Bucarest, chemist Anghelopol showed the same chemical composition.

The concentration of total dissolved solids (TDS) is up to 1,300 ppm, mostly calcium-sulphate-bicarbonate type, the main elements present being Ca, Mg, Na, K, Li, Mn, Fe. There are also small quantities of dissolved non-condensable gasses (up to 200 ppm) mainly CH4 and CO2 (Cohut and Tomescu, 1993). A very small content of 222 Rn (about 23 – 70 pCi/l) makes the geothermal water undrinkable in general, but also strongly contributes to its therapeutic effect in health bathing.

Calculations based on the chemical composition of the geothermal fluid (and confirmed by practice) show a very low scaling potential only at temperatures below 20°C (Rosca, 1993). The geothermal water from the Felix Spa reservoirs is neutral (pH 6 at 20°C). Corrosion problems caused by the geothermal fluid were not reported up to present. As the reservoir is located in fractured limestones, no sand was reported to exist in the geothermal water.

Out of the nine geothermal wells drilled in Felix Spa, only six are currently in use. The two oldest wells in Romania were drilled in Felix Spa, the first in 1885 (which can still produce up to almost 200 l/s), and the second in 1887 (now closed).
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All wells are producing in artesid discharge. The total exploitable flow rate in Felix Spa was set by the National Agency for Mineral Resources at 250 l/s annual average to prevent a reservoir pressure decline and to protect the natural reserve of Nymphaea Lotus, variety *Thermalis*, a tertiary remnant that grows naturally in geothermal ponds and is very uncommon at this latitude (about 45°C) and therefore a tourist attraction.

**THERAPEUTIC EFFECTS OF THE FELIX SPA GEOTHERMAL WATER**

Therapy with natural factors is different from therapeutic methods used by the medical and surgical specialties. The medical and surgical specialties were grouped into the classifications made by Hoff (1956) and Jung (1971) in three method groups, called “artificial” methods.

The therapy with natural factors represents the fourth group—therapeutical methods—in the above classification. It is totally different from “artificial methods” because it uses the body to obtain its stabilization, train its functions and eventually heal. This method is also called stimulation therapy, reaction or adaptation therapy (Jordan, 1975).

The systematically, successively, measured application of some thermal, mechanical, chemical and kinetic factors determines complex adjusted responses of the body’s functions. These responses are important for physical rehabilitation and for prophylaxis. The methods use the newest discoveries from modern adaptive physiology—thermic homeostatic physiology, muscular and nervous physiology, and biorhythm physiology.

Using natural therapeutic factors leads to developing the concept of a balnear cure. There are three types of balnear cures: prophylactic, therapeutic and rehabilitation. Each has distinct objectives and end points. But there are other modern therapies that have developed recently in Felix Spa: wellness therapy, anti-stress therapy, anti-fatness therapy, anti-aging therapy and fitness therapy. All use natural factors in association with physiotherapy. Their beneficial effects are well known and appreciated. The cures last from one to three weeks, depending on the diagnosis.

The geothermal waters from Felix Spa are used for prophylaxis, treatment and physical rehabilitation. They are used for external cures in pools, bathtubs and for all hydrothermal therapeutic procedures, including vaginal irrigation. The treatment installations include:

- bathing with thermal-mineral waters in tubs and pools;
- kinetic therapy in thermal mineral waters in tubs and pools;
- vertebral traction (elongation on the table and in water);
- electro- and hydrotherapy;
- hydrokinetic therapy;
- rehabilitation and medical gymnastics;
- paraffin wrappings; and
- inhalations.

The water from the “Balint” well, with a radon content below the admissible limits for drinking, is used for internal cures for patients with digestive, liver and renal illnesses.

The actions of the geothermal waters from Felix Spa on the human organism are generated by three significant factors: the thermal factor, the chemical factor and the mechanical factor.

The thermal factor is due to the water temperature. The water used is about 36-37°C for external cures in pools or tubs and has the following effects:

- increase the heart rate from 20 to 30 beats/min;
- increase the cardiac flow by raising the heart rate and flow beat;
- modify the blood flow: the diastolic blood pressure lowers at the beginning at about 50 to 55 mm Hg and is kept low during the procedure, with the tendency of progressive return to normal values; the systolic blood pressure lowers in the meantime with the diastolic blood pressure, but less—as a rule not under 110 mm Hg; the average blood flow decreases at the beginning and then reverts to normal;
- heart stress is relatively moderate in comparison with the normal performed physical effort and it works in a much more economical regime;
- the breathing rate increases moderately, which doesn’t modify the blood PH;
- control the contractions and the muscular spasms by relaxing the skeletal muscles, which will lead to an increase in the range of motion;
- control chronic osteoarticular, periarticular and soft tissue pain;
- control chronic inflammatory and stagnant oedemas;
- rebalance the neurovegetative system by controlling the sympatheticotony.

The chemical factor is represented by the chemical structures of the waters. The low mineralization doesn’t decrease the pharmacodynamic value of its elements. The presence of radon increases the electrolytic dissociation state and makes them pharmacodynamically very active. Through skin transmineralization (well scientifically and experimentally certified) it makes up a double exchange between the body and the therapeutical physical medium—the thermon mineral radonate water. It means that the ionic, structural elements of the water will recover in the body’s structures and other elements will be eliminated from the body to the water. Thus there is not only a migration of K, Ca, Mg, Fe, sulfates to the body, but also an important elimination of Na, urea, acid radicals. Entering K, Ca, Mg, Fe have important roles in muscular and bone metabolism. This Na and K pump could explain close-by action of the other factors plus the contribution of the chemical factor to the regulation of blood flow. During the treatment, the radon gets through the skin and into the blood flow. It is eliminated through the lungs. The degree of resorption is amplified by the water temperature. Depending on room ventilation, up to 29 percent from the radon can be inhaled. It is disintegrated in three hours after finishing the treatment and it represents a great advantage by avoiding the long action of radiation. We recommend that patients not take a shower for three hours after finishing their treatments.

The most important effects are:

- normalizing the glucidic metabolism;
-favorable effects in purinic metabolism through the action of the radon on the hypophysis-suprenal system; the increase of uric acid elimination up to 30 percent, with favorable results in gout arthropathy and in X metabolic syndrome;

-increase in local tissue metabolism—the growing need of oxygen is provided through vasodilatation;

-on the urinary system—the renal function maintains fluid homeostasy. There are two steps: the first appears through consensual reflex renal vasodilatation, which leads to increasing the renal perfusion and increasing the diurese (urinary flow); the second—in releasing thermolisis, the renal function interferes in fluid economy—renal vasoconstriction—decreasing the diurese;

-on the cardiovascular system—the decrease of the heart rate, an increase of the flow beating, improved coronary irrigation and lowering the total peripheral resistance; the decrease of the blood flow in hypertension and normalizing it in hypotension; increased periferical vasodilatation through:

Direct effect of heat on the vascular wall;

Reflex mechanism of three types:

-axon reflex;

-metamer reflex—through a reflex arch closed at the medular level. The result is a general vasodilatation in that metamer;

-consensual reflex—it will determine a total vasodilatation in all the periferical circulation;

-the augmentation of blood volume by releasing blood from the storage organs (liver, spleen, subpapilar venous plex); the skin, renal and myocardial vessels react in the same way—after the Dastre–Morath law—through vasodilatation; the others organ vessels react in the opposite way; the blood speed in the periferical vessels increases by 1/3 to 1/2;

-on the nervous system—the action is on the nucleic metabolism, on the cerebral circulation and microcirculation with the increasing possibility of using oxygen by the cerebral tissue. It controls the pain in neuralgia and neuritis;

-rebalance the neuro-vegetative and hormonal systems, thus influencing the biologic balance of the whole body including the psychic equilibrium that is manifested first as a sedation state, even drowsiness, then as euphoria, a state of "well being."

-on the immune system—the vasodilatation determines a good perfusion of the tissues with blood, which contributes to antibody mobilization. The warmth has a direct effect of high temperatures on the heat-sensitive germs (bactericid action). In illness with modified reactivity (Ankylosing Spondylitis), the warmth has an unspecific, immunologic effect.

The mechanical factor is represented in the pools by hydrostatic pressure according to Pascal’s principle, and by forces pushing upward according to Archimede’s law. That leads to beneficial effects, especially on the locomotor system and on the cardiovascular system. Thus the immersion of the body in water modifies the weight of the organism, reducing or unloading it, the percentage varying with the level of immersion:

-at the leg level—95 percent of the weight;

-until the half of the hip—80 percent of the weight;

-until the trochanteric line—66 percent of the weight;

-the navel zone—50 percent of the weight;

-the nipple line—33 percent of the weight;

-until the cervical zone—7 percent of the weight.

The effect on the locomotor system is beneficial in all cases and especially in those in which the movement against gravity is at the limit or impossible, or when there are disorders of the agonist and antagonist muscular groups, when because of the lacking of the muscular strength, the movement is performing incomplete and hesitating.

On the cardiovascular system, the unloading of weight will diminish the force necessary for movement and lower the cardiac effort. The hydrostatic pressure is higher at the bottom of the pool and decreases nearer the surface of the water, thus this pressure acts as a returning pump on venous–limphatic circulation.

The pressure on the abdominal and torachal cavity will facilitate the venous return from these territories and will fortify the inspiratory muscles.

The main indications for geothermal waters from Felix Spa are:

-inflammatory rheumatic diseases, biologically stable (rheumatoid polyarthritis, ankylosing spondylitis, post acute articular rheumatism);

-degenerative rheumatic effects: spondylisis (cervical, dorsal, lumbar) accompanied or not by cervicobrachialgias, painful lumbar sciatica, arthroses, poliarthroses;

-abarticular rheumatic affections (tendinoses, tendinites, tendoperiostoses, scapulohumeral periarthritis);

-posttraumatic effects (posttraumatic articular stiffness, states following articular surgery, fractures);

-effects of the central and peripherical nervous system—sequaral hemipareses through CVA no matter what the etiologie, mielytis and sequelae after meningencephalitis, various pareses and paralyses, parapareses, tetrapareses after vertebral trauma with medular—especially concerning those operated on for vertebral stabilization, states after cervical or lumbar disc hernias operated or reoperated,—even in paretical states, neuralgias, neuritis, radiculopathias, especially because of a discal vertebral illness, states after operations for:

-metabolic illneses: obesity, gout, diabetus mellitus;

-hypertension state I and II, chronic ischimic cardiopathy, arteriopathy, milkleg;

-endocrine illness like hypotiroidia;

-for prophilaxy—for everyone who has risk factors for locomotor illnesses, especially for sedentary people, stressed people, those with termoreglation disturbances,
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with nervous disturbances like neuroses and sleeping disorders and for people with neurovegetative disorders.

CONCLUSION

The effects of geothermal waters from the Felix Spa are well known and beneficial. It is worthwhile to pay more attention to the treatment of different illnesses in this ancient and beautiful spa.

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