

Health Effects of Dead Sea Climatotherapy on Patients with Heart and Lung Diseases

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Abstract

Introduction: The Dead Sea (Sea of Salt in Hebrew), the lowest saline lake on earth, contains high concentrations of salts and is a reservoir of minerals with a unique evaporation regime. The magnesium salts and the sulfur-containing mud in addition to the unique ultra-violet (UV) radiation reaching this area are the main factors used for treating skin disorders and arthritis, as well as respiratory diseases. High and stable temperatures are the main characteristic of this dry region, located at 420 meters below sea level, benefiting also from high barometric pressure (800 mm Hg), and therefore from a higher oxygen partial pressure.

Material and Methods: The influence of a sojourn in these exceptional climatic conditions was studied on patients suffering from heart and from lung diseases. Stress test and cardiac ultra-sound imaging, as well as lung function tests were obtained before and after a sojourn at the Dead Sea area.

Results and Conclusion: In their conclusions, the authors emphasized the positive changes in the condition of the patients, as well as the safety and the possible beneficial effects of such a stay. Even if natural climatotherapy at the Dead Sea for skin and joint diseases has been proven both highly effective and almost without side effects, more studies are necessary for defining and delimiting optimal protocols to be followed by patients suffering from heart and lung diseases.

Key words: Cardiac Disease, Chronic Obstructive Lung Disease, low altitude, Dead Sea.

Efectos saludables de la Climatoterapia del Mar Muerto en pacientes con enfermedades cardíacas y pulmonares

Resumen

Introducción: El Mar Muerto (Mar de la Sal, en Hebreo), el lago salino más bajo de la tierra, contiene altas concentraciones de sales y es un reservorio de minerales con un régimen de evaporación único. Las sales de magnesio y el azufre que contiene el barro, además

de la radiación ultra-violeta (UV) única que llega a ésta área son los principales factores utilizados para el tratamiento de trastornos de la piel y artritis, así como enfermedades respiratorias. Las altas y estables temperaturas son la principal característica de esta seca región, que se encuentra a 420 metros bajo el nivel del mar, beneficiándose también de alta presión barométrica (800 mm de Hg), y por lo tanto de una mayor presión parcial de oxígeno.

Material y Métodos: La influencia de una estancia en estas condiciones climáticas excepcionales, se ha estudiado en pacientes que sufren del corazón y de enfermedades pulmonares. Prueba de esfuerzo y ecografía cardíaca, así como pruebas de función pulmonar fueron obtenidas antes y después de una estancia en la región del Mar Muerto.

Resultados y Conclusiones: En sus conclusiones, los autores hicieron hincapié en los cambios positivos en el estado de los pacientes, así como la seguridad y los posibles efectos beneficiosos de tal estancia. Aunque la climatoterapia natural en el Mar Muerto se ha demostrado muy eficaz para las enfermedades de piel y articulaciones y casi sin efectos secundarios, son necesarios más estudios para definir y delimitar protocolos óptimos a seguir por los pacientes que sufren de enfermedades cardíacas y pulmonares.

Palabras clave: Enfermedad Cardíaca, Enfermedad Pulmonar Obstructiva Crónica, Altitud Baja, Mar Muerto.

REFERENCE STANDARD

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BACKGROUND

The Dead Sea is a terminal desert lake remaining from an earlier series of lakes which spread along the Syrian African rift during prehistoric times. It represents the lowest salt lake on earth being situated at exactly (to date) minus 423 meters below sea level.

Due to the mineral content of the lakes ground which dissolves into the water has turned the lakes salt unique both in composition and in concentration. As a result these waters contain a high concentration of cations such as magnesium, sodium and calcium and anions such as phosphorus, bromide and chloride. The high ionic pressure raises the density of the water to 1.237 Kg/L. This special composition and concentration of the water does not permit the life of organisms short of specifically adapted unicellular organism such as halophytic bacteria and algae.

The low altitude of the area results in an elevation of the atmospheric pressure which in turn causes a five to six percent increase of the partial oxygen pressure. Natural springs containing mainly sulfur and some other minerals are being located

along the Dead Seas shores. Black mud containing hyperemic and some antibacterial properties can be found on the lakes shores.

The area is characterized by a dry stable temperature reaching high levels in midsummer months while the rainfall is extremely low in winter. The air is, in view of the scarcity of industry and car traffic unpolluted and has in view of limited vegetations a low allergenic content but is rich in certain aerosols such as bromides and magnesium¹.

Solar rays in the area are also unique and are discussed in detail in other publications²⁻³.

This special combination of beneficial natural agents is unparalleled in the world⁴⁻⁵.

HEALING PROPERTIES AT THE DEAD SEA

Some of the unique properties of the Dead Sea were already considered in Greek and Roman times to be beneficial for a host of diseases so that even King Herod while being terminally ill, went to be exposed to its waters. In the ancient Jewish scripts, the Dead Sea is mentioned with the issue whether bathing should be, or should not be permitted on a Shabbat (the Talmud, Jewish code of civil and ecclesiastic laws).

While in medieval times the area fell into disregard and neglect, it arose a new interest in the middle of the last century, first by dermatologists and rheumatologists as being of value for the treatment of skin and joint diseases which are largely dealt in other numerous publications (Ingber⁶, Kushelevsky⁷, Abels⁸, Karagulle⁹ and Sukenik¹⁰ and very recently¹¹). Since then the types of diseases successfully treated in the Dead Sea area have increased, including presently certain heart and lung diseases and an eye disease, chronic Uveitis¹².

HYPERTENSION AT THE DEAD SEA

There is no contraindication for hypertensive patients to be exposed to climatotherapy at the Dead Sea. This statement was not always the rule, and in the past, many patients were unwanted at the Dead Sea because of their high blood pressure.

Bernheim was the first who published an article about a decrease of blood pressure at the Dead Sea area, in 1984¹³. However, the major contribution to this issue was the study published ten years later by the team of Shani and Kushelevsky¹⁴. In this prospective clinical trial, diastolic and systolic blood pressure of 1366 psoriatic patients, treated at the Dead Sea for a period of 4 weeks, was monitored from the day following their arrival. The plaque psoriasis patients were divided into three categories: (a) patients on antihypertensive medication; (b) patients not receiving

antihypertensive medication, but whose initial diastolic blood pressure equaled or exceeded 90 mmHg, and (c) patients with normal blood pressure (diastolic pressure lower than 90 mmHg). A paired t-test revealed that the systolic blood pressure of the two hypertensive groups (a and b) dropped by an average of 22 mmHg, and the diastolic blood pressure dropped by 11 and 16 mmHg, respectively. The drop was evident 2 days after their arrival, and leveled off only after 2 weeks. A similar drop in systolic blood pressure was observed in normotensive patients with psoriasis. On the basis of this study the authors concluded that high blood pressure does not remain a contraindication for the treatment of psoriasis at the Dead Sea, as though previously.

Continuing their research, the same scientists examined the responses of various age-groups of psoriatic patients to a four-week period of climatotherapy at the Dead-Sea¹⁵. In a first study, plaque clearance following climatotherapy was evaluated in a group of 688 patients with plaque psoriasis, as a function of age, gender and duration of the disease. Neither the age of the patient treated, nor the duration of the disease, appeared to influence the degree of plaque clearance. In the second study, the type and incidence of side effects after climatotherapy was studied in 502 patients aged over 65, and in more than 4,500 younger plaque psoriasis patients. There was no difference in the type and frequency of side effects between the two age-groups. The most frequent side effects were: slight sun burn (8.2%), sun allergy (5.0%), common cold (3.4%), leg edema (2.0%), diarrhea (1.4%) and herpes simplex (0.8%). In all cases the side-effects disappeared within a few days.

In the third study, the reduction in the diastolic and systolic blood pressures in a group of 1,142 hypertensive patients with plaque psoriasis was evaluated as a function of time. It was demonstrated that while there was no significant age-dependent difference in lowering their diastolic blood pressure throughout the study, differences in lowering systolic measurements between the younger (< 40 y) and older (> 65 y) hypertensive patients were highly significant. On the basis of these studies the authors conclude that plaque psoriasis patients aged 65 and over benefit from climatotherapy at the Dead-Sea no less than younger patients, and that, irrespective of age, high blood pressure is definitively not a contraindication for this treatment in psoriatic patients.

Confirming these conclusions, Paran¹⁶ published later on a study in which blood pressure changes were compared in 72 hypertensive and normotensive patients staying in Beer Sheva (barometric pressure 745 mmHg) and at the Dead Sea (barometric pressure 800 mmHg). The sojourn at the Dead Sea showed an average decrease of 17 mmHg, a change that diminished slightly after 10 days stay at the Dead Sea.

HEART DISEASES AT THE DEAD SEA

In view of the raised partial pressure of oxygen present in the area, studies on patients suffering from Chronic Ischemic Heart Disease are of special interest.

It was Abinader¹⁷⁻¹⁸, in 1998, who followed first a group of cardiac patients both after by-pass operation and after catheterization after their stay at the Dead Sea and noted an improvement in their condition.

The biological effects of low altitude on exercise performance and myocardial ischemia were evaluated on 12 patients with coronary artery disease (CAD) and 6 normal controls that underwent stress test and exercise echocardiography study in Haifa, 130 meters above sea level and at the Dead Sea. Exercise duration increased at the Dead Sea by 15% ($p < 0.05$) in both groups indicating that descent to the Dead Sea in patients with CAD is safe, improves exercise performance and decreases ischemia. The same conclusions were drawn by the authors for Chronic Heart Failure (CHF) after evaluation of 12 patients and 4 matched controls. Cardiac output at rest increased by 300 ml/min ($p < 0.05$) and maximum oxygen consumption (VO_2 max) increased by 126 ml/min ($P < 0.05$).

Twelve years later, another study on patients suffering chronic heart disease will be published. Gabizon, Katz and associates¹⁹ studied the effect of descent and stay at the Dead Sea Health resort on patients with systolic congestive heart failure and an implantable cardioverter defibrillator (ICD) with or without resynchronization therapy, evaluating the issue of safety, quality of life (QOL), exercise capacity, heart failure and attacks of arrhythmia. The study included 19 patients aged 65.3 ± 9.6 years of whom 16% were males. The travel to and from the Dead Sea area was well tolerated and uneventful. The QOL improved by 11 points and the six minute walk test increased by 63 meters ($p = 0.001$). B-type natriuretic peptide (BNP) increased slightly (without statistical significance), while heart rate variability (HVR) decreased ($p = 0.018$). No significant changes in blood pressure, weight, O_2 saturation and ejection fraction were found.

The conclusion drawn by the authors was that under these particular conditions descent, ascent and stay at the Dead Sea resort are safe and might be beneficial in some aspects in patients with systolic congestive heart failure and an ICD.

LUNG DISEASES AT THE DEAD SEA

Due to the raised partial O_2 pressure and scarcity of allergens, patients with chronic lung diseases (asthma as well as with cystic fibrosis) have also benefited from a stay in the area, since decades. Since 1998, authors published their preliminary observations on asthmatic patients, in which they described improved lung function, reduction of severity and number of asthma attacks and improvement of beta-2-agonist efficacy²⁰. The absorption of magnesium through the skin and via the

lungs was raised up as a possible mechanism of this improvement. However, oxygenation of patients staying at the Dead Sea versus those living in Jerusalem was the main issue studied by many scientists²¹. Finally, some of them even describe the stay in this area as a hyperbaric-like treatment²².

Kramer studied patients with chronic lung disease such chronic obstructive pulmonary disease (COPD) patients and found that after a stay at the Dead Sea²³. Such patients showed a rise in their PO₂ and SaO₂ and their exercise capacity with consequently an improvement of their quality of life²⁴.

Golbart²⁵ studied a group of Cystic Fibrosis patients who, after a three weeks stay at the Dead Sea area, showed an improvement in their FEV₁, their SaO₂ and their appetite, leading to an increased weight. These positive changes lasted after their return home. Exercise capacity and cardiopulmonary response to exercise in cystic fibrosis patients were also found improved in another clinical trial on children²⁶. The safety issues often raised by many regarding rehabilitation centers were addressed in another study: no cross infection with *Pseudomonas bacilli* was noted in these patients²⁷.

Recently, Griese et al published a retrospective review on 142 cystic fibrosis patients aged 2-46 years who participated in rehabilitation programs taking place in Europe and in Israel. Overall lung function and weight improved in 97 patients during 172 stays at the Dead Sea, but the authors concluded on the need to assess these changes through prospective studies in order to optimize the rehabilitation outcomes²⁸.

CONCLUSION

It turns out that the unique geographical and climatic features present at the Dead Sea permit appliance of climatotherapy, including heliotherapy, thalassotherapy, pelotherapy and balneotherapy, separately or in combination, in an effective way, for a variety of diseases. These unique features provide the physician at the Dead Sea with a wide range of therapeutic potentials in chronic conditions which do not exist elsewhere in the world. Skin and joint diseases were the first and the well-studied issues considered, through thousands of treatments realized in the medical centers present in this area, since 1980.

A few studies were devoted to the physiological changes occurring in the respiratory and the cardiac system. However, their conclusions should encourage scientists to plan both clinical and laboratory trials in these fields. Older patients, seeking relief from symptomatic skin or joint conditions, but also suffering from more than a single chronic disease, should be welcome at the Dead Sea and enjoy a successful and safe treatment in more than only one indication.

In addition to its spectacular effects on the skin and the joints of many patients, the Dead Sea is also a source of powerful relaxation and psychological strengthening. Dead Sea is good for the soul, good for the heart and good for the lungs²⁹.

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