

WORLD-WIDE STUDIES OF WHOLE BODY CRYOTHERAPY

Effect of whole body cryotherapy on the levels of some hormones in professional soccer players

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INTRODUCTION: The study was undertaken to determine blood serum concentrations of selected steroid hormones (estradiol--E(2), testosterone--T, dehydroepiandrosterone sulfate--DHEA-S) and luteinizing hormone (LH) in professional footballers subjected to whole body cryotherapy. **MATERIAL AND METHODS:** Twenty-two clinically healthy males, mean age 26.7 years, were studied. The subjects underwent ten sessions of whole body cryotherapy in Wrocław-type chamber, with kinesitherapy following each session. Blood samples were collected before and two days after the treatment and the results were analyzed statistically. **RESULTS:** After the treatment there was a significant decrease in the concentrations of T (6.01 vs. 4.80 ng/mL, $p < 0.01$) and E(2) (102.3 vs. 47.5 pg/mL, $p < 0.00001$), but no DHEA-S and LH. The T/E(2) ratio showed a significant increase from 72.2 to 136.5 ($p < 0.01$). **CONCLUSIONS:** Whole body cryotherapy leads to a significant decrease in serum T and E(2), with no effect on LH and DHEAS levels. As a result of cryotherapy, the T/E(2) ratio was significantly increased. The changes observed are probably due to cryotherapy-induced alternation in the blood supply to the skin and subcutaneous tissue, as well as to modulation of the activity of aromatase which is responsible for conversion of testosterone and androstenedione to estrogens.

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The influence of whole body cryotherapy on mental health

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The paper presents a little known issue about the influence of wholebody cryotherapy on mental health. Observations of patients' behaviour after passing the cryogenic chamber leads to an interesting hypothesis. Short exposition to extreme cold has doubtless a profitable influence on man's frame of mind. Immediately after passing the cryogenic chamber, apart from the well known analgetic effect, we detect changes in patients' mental state such as improvement of mood, deep relaxation, freshening up, consolation, euphoria. This unusual state lasts for a long time after ending the cycle of cryotherapy. Different mechanisms of this effect are considered. New possibilities of this method have been presented. Durability of such an advantageous phenomenon are investigated in our research centre in Wrocław.

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BENEFICIAL EFFECTS OF THE WHOLE-BODY CRYOTHERAPY ON SPORT HAEMOLYSIS

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Background. Sport's anemia is a common risk for athletes. The principal source of an accelerated turnover of the erythrocytes in sportsmen is the intravascular hemolysis. This phenomenon is induced by mechanical breakage for impact of feet and muscular contractions, but also by osmotic changes causing membrane fragility, typically evident after exercise, when free radicals are increased. Whole-body cryotherapy (WBC) covers a wide range of therapeutic applications and consists of briefly exposing the body to extremely cold air. In sports medicine, WBC is used to improve recovery from muscle injury; however, empirical studies on

its application to this area are lacking. Design and Methods. We recruited ten rugby players of the Italian National Team. In these athletes we measured hematological parameters, before including mean spheroid cell volume (MSCV) by means of Coulter LH750, besides of haptoglobin, and after WBC. The subjects underwent five sessions on alternate days once daily for one week. During the study period, the training workload was the same as that of the previous weeks. Results. We observed in the athletes increase of haptoglobin and an increase of MSCV after the treatment period. Conclusions. WBC reduces sports haemolysis, as judged from MSCV and haptoglobin data, supported from other haematological values, as well as the absence of mean corpuscular volume and reticulocytes increase. The treatment is useful to prevent the physiological impairments derived from sport haemolysis.

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Whole-body cryotherapy in patients with inflammatory rheumatic disease. A prospective study

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BACKGROUND: : As yet, whole-body cryotherapy is especially used for the therapy of chronic inflammatory arthritis. An analgetic effect has been described in several studies. However, only few data exist concerning the long-term effects of this therapy. **PATIENTS AND METHODS:** : A total of 60 patients with rheumatoid arthritis (n = 48), and ankylosing spondylitis (n = 12) was analyzed. Patients underwent treatment with whole-body cryotherapy twice a day. The average age was 55.7 +/- 10.33. The study group consisted of 48 female and twelve male patients. The average number of therapeutic treatments with cryotherapy was 15.8 +/- 8.37, the average follow-up 63.4 +/- 63.48 days. **RESULTS:** : 13 patients (21.7%) discontinued treatment because of adverse effects. For patients with rheumatoid arthritis, DAS28 (Disease Activity Score) and VAS (visual analog scale) were determined. A significant reduction of both parameters was found (DAS 3.9 +/- 1.22 vs. 3.4 +/- 1.08; p < 0.01; VAS 51.4 +/- 16.62 vs. 37.9 +/- 19.13; p < 0.01). BASDAI (Bath Ankylosing Spondylitis Disease Activity Index) was analyzed for patients with ankylosing spondylitis, and also showed a significant reduction (4.4 +/- 1.91 vs. 3.1 +/- 1.34; p = 0.01). **CONCLUSION:** : Thus, whole-body cryotherapy is an effective option in the concept of treatment of inflammatory rheumatic diseases. The relief of pain allows an intensification of physiotherapy. A significant reduction of pain over a period of 2 months could be shown.

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Whole-body cryotherapy in rehabilitation of patients with rheumatoid diseases--pilot study

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Cryotherapy as a whole-body cold therapy (with cold air cooled by addition of nitrogen blown on the patients in an open cabin) for treatment of inflammatory rheumatic diseases already started in Bad Säckingen in 1986. In 1996, a new cold chamber (this time a closed chamber without any addition of nitrogen) based on compressor technology was introduced. The aim of our study was to test whether significant pain relief could be achieved by means of this cold therapy. Furthermore, we were interested in the practicability and acceptance of this new technique. Wellbeing during the treatment application and pain level were assessed using verbal and numerical rating scales. The sample consisted of 120 consecutive patients (75% women, age: 30-67 yrs, M = 52.6 yrs). These patients were suffering from primary fibromyalgia (40.7%), rheumatoid arthritis (17.3%), chronic low back pain (16.4%), ankylosing spondylitis (10.9%), osteoarthritis (9.1%), secondary fibromyalgia (3.6%) and other autoimmune diseases (1.8%) (mean duration of symptoms: 4 yrs). The patients were treated 2.5 minutes on average in the main chamber (mean temperature: -105 degrees C). The patients' statements concerning their pain level were analyzed by means of analyses of variance with repeated measures and paired-sample t-tests. **RESULTS:** The pain level after application of the cold therapy decreases significantly. The pain reduction lasts about 90 minutes. The initial pain level decreases during the whole time of treatment, no significant improvement, though, can be shown from the middle to the end of the four-weeks treatment. According to the results of

our study, there is evidence that the whole-body cold therapy generates important short-term effects and somewhat weaker effects over the treatment period as a whole. Short-term pain reduction facilitates intensive application of physiotherapy and Occupational Therapy. The treatment procedure is practicable, and all in all well tolerated. From the patients' point of view, whole-body cold therapy is an essential part of the rehabilitation programme.

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Whole-body cryotherapy as adjunct treatment of depressive and anxiety disorders

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INTRODUCTION: Rheumatism has been treated using whole-body cryotherapy (WBCT) since the 1970s. The aim of this study was to assess the efficacy of WBCT as an experimental, adjunctive method of treating depressive and anxiety disorders. **MATERIALS AND METHODS:** A control (n=34) and a study group (n=26), both consisting of outpatients 18-65 years old with depressive and anxiety disorders (ICD-10), received standard psychopharmacotherapy. The study group was additionally treated with a series of 15 daily visits to a cryogenic chamber (2-3 min, from -160 degrees C to -110 degrees C). The Hamilton's depression rating scale (HDRS) and Hamilton's anxiety rating scale (HARS) were used as the outcome measures. **RESULTS:** After three weeks, a decrease of at least 50% from the baseline HDRS-17 scores in 34.6% of the study group and 2.9% of the control group and a decrease of at least 50% from the baseline HARS score in 46.2% of the study group and in none of the control group were noted. **CONCLUSIONS:** These findings, despite such limitations as a small sample size, suggest a possible role for WBCT as a short-term adjuvant treatment for mood and anxiety disorders.

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Effects of the whole-body cryotherapy on NTproBNP, hsCRP and troponin I in athletes

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Whole-body cryotherapy refers to brief exposure to very cold air for treating symptoms of various illnesses. In sports medicine, whole-body cryotherapy is administered to improve recovery from muscular trauma. As specific studies are lacking, we measured cardiac markers in 10 top-level rugby players of the Italian National team before and after a 1-week course of daily sessions of whole-body cryotherapy. All subjects continued with the same training workload as that of the previous weeks. N-terminal pro B-type natriuretic peptide (NTproBNP) levels increased but remained within the normal range, whilst troponin I (TnI) and high sensitivity C-reactive protein (hsCRP) were unchanged. Whole-body cryotherapy did not impair cardiac function in this sample of elite athletes.

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Evaluation of effectiveness of whole-body cryotherapy in patients with tinnitus

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INTRODUCTION: The aim of the study was evaluation of effectiveness of whole-body cryotherapy in patients with tinnitus. **MATERIALS AND METHODS:** The research was carried out in 120 patients (aged 20-

68) with tinnitus, divided into two groups: I--80 patients treated by cryotherapy and II--40 patients non treated. There were: 73 women and 47 men. Among patients of I group: 39 reported bilateral tinnitus, 20 reported right tinnitus, 15 reported left tinnitus and 6 reported tinnitus in head. Duration of the ailment took from 1 month to 23 years. The methods included: taking a history, otolaryngological physical examination, audiometry establishing level of tinnitus, medical consultation, X-ray examination of chest and cervical spine and CT of head. After examinations and additional consultations the patients were qualified for cryotherapy unless there were some contraindications. The patients underwent 10 procedures in two cycles with the weekend break. They were in cryochamber in temperature of -110 degrees C for 3 minutes. After cryotherapy they used kinesitherapy for 45 minutes. Intensity and troublesomeness of tinnitus was evaluated using self-assessment chart (point scale 0-100) and audiometry establishing level of tinnitus before and after treatment. RESULTS: The results indicates complete elimination of tinnitus in 4 patients, decrease in their intensity in 47 patients, maintenance of the ailment on the same level in 13 people and slightly increase of tinnitus in 16 patients. In audiometry we could observe in I group changes in frequency of tinnitus in 138 ears and changes in intensity of tinnitus in 91 ears. After treatment decrease of average hearing loss and average hearing damage were observed. CONCLUSIONS: Treatment of tinnitus may be effective by using whole-body cryotherapy.

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Serial Whole-Body Cryotherapy in the Criostream for Inflammatory Rheumatic Diseases. A Pilot Study

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BACKGROUND AND PURPOSE: Local as well as whole-body cryotherapy is used to relieve pain and inflammation in rheumatic diseases. In comparison with a chamber-based whole-body cryotherapy, the novel criostream whole-body therapy (single-person cabin with cold air cooled by liquid nitrogen) as an innovative technique offers not only a rapid therapeutic effect but also a considerable reduction in costs. The aim of this study was to compare the effect of whole-body cryotherapy in the criostream on pain reduction, disease activity and pro-inflammatory cytokines (tumor necrosis factor-[TNF-]alpha and interleukin-[IL-]1), and improvement in functional scores. PATIENTS AND METHODS: Ten patients with different active inflammatory rheumatic diseases (four patients with rheumatoid arthritis, three patients with ankylosing spondylitis, and three patients with psoriatic arthritis/spondylitis) underwent nine sessions of whole-body cryotherapy in 5 days for a short time period (at first 90 s, with step-up in each application to 2.5 min total time). RESULTS: Pain and disease activity scores decreased significantly, and, subsequently, also the functional scores showed a significant amelioration. Furthermore, there was a significant reduction in TNF-alpha ($p < 0.01$) and IL-1 ($p < 0.05$). Side effects were reported only after the first application in two cases (headache and sensation of cold). CONCLUSION: The criostream offers an elegant and, from the patient's point of view, attractive therapeutic agent in the multimodal treatment concept for inflammatory rheumatic diseases.

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Lung function after acute and repeated exposures to extremely cold air (-110 degrees C) during whole-body cryotherapy

Authors: J Smolander, T Westerlund, A Uusitalo, B Dugué, J Oksa, M Mikkelsen



Whole-body cryotherapy (WBC) is one mode of cold therapy, during which rheumatic patients are exposed to very cold air (-110 degrees C) in minimal clothing. It is also proposed to have a bronchodilatory effect. The aim was to examine the effects of WBC on lung function in healthy humans after acute and repeated

exposures. Twenty-five healthy, non-smoking subjects participated in the study. They were exposed to WBC for 2 min three times per week for 12 weeks. The peak expiratory flow rate (PEF) and forced expiratory volume in 1 s (FEV1) were measured before and after (at 2 and 30 min) the first WBC, and then similarly at 4, 8 and 12 weeks. At all time points, after 30 min of the WBC the PEF values were slightly lower compared with values before the WBC, and the reductions reached statistical significance at 1 month (5.1 +/- 1.2%), and at 3 months (3.2 +/- 1.7%). After 30 min of the first WBC, the FEV1 was significantly reduced by 2.3 +/- 0.8%, but no other changes were observed during the study. In conclusion, the WBC induced minor bronchoconstriction in healthy humans instead of proposed bronchodilatation. The WBC seems not to be harmful for lung function, but should be used with caution in susceptible individuals.

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Thermal sensation and comfort in women exposed repeatedly to whole-body cryotherapy and winter swimming in ice-cold water

Authors: *Juhani Smolander, Marja Mikkelsen, Juha Oksa, Tarja Westerlund, Juhani Leppäluoto, Pirkko Huttunen*



Whole-body cryotherapy (WBC; -110 degrees C) and winter swimming (WS) in ice-cold water are severe ambient cold exposures, which are voluntarily practiced by humans in minimal clothing. The purpose was to examine thermal sensation and thermal comfort associated with WBC and WS. Twenty women similar in body mass index, age, physical activity, and use of hormonal contraception were pairwise randomized either to the WBC group or the WS group. The duration of each WBC exposure was 2 min, which was repeated three times per week for 3 months (13 weeks). Similar exposure frequency was used for the WS group, but each exposure lasted 20 s in outdoor conditions. Thermal sensation and comfort were asked with standard scales. After WBC, 65% of the thermal sensation votes were 'neutral' or 'slightly cool.' After WS, 81% of the thermal sensation votes were 'warm,' 'neutral,' or 'slightly cool.' Majority of comfort votes immediately after exposures in WBC group (98%) and in the WS group (93%) were 'comfortable' or 'slightly uncomfortable.' Thermal sensation and comfort became habituated in both groups at an early stage of trials, but the changes were less conclusive in WS group due to variable conditions outdoors. In the WBC group, cold sensation was less intense already after the second exposure. In conclusion, repeated exposures to WBC and WS in healthy women were mostly well tolerated and comfortable. The results indicate that during repeated severe whole-body cold stress of short duration, thermal sensation and comfort become habituated during the first exposures.

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Acute and long-term effects of winter swimming and whole-body cryotherapy on plasma antioxidative capacity in healthy women

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The effects of severe cold stress on total peroxy radical trapping antioxidant capacity of plasma (TRAP) were studied in two groups of healthy women: a whole-body cryotherapy group (WBC, n = 10) and a winter swimming group (WS, n = 10). The biovariability of TRAP values was also analysed. The WBC group was exposed to -110 degrees C for 2 min, whereas the exposure for the WS group lasted 20 s in ice-cold water. Sessions were organized three times per week for 12 weeks. Blood specimens were collected at 2, 4, 8 and 12 weeks at rest, 2 and 35 min after the cold exposures and at the corresponding times without cold exposure on a separate day. Conventional methods were used to determine TRAP values. The between-subject variation was 13.6% and the within-subject variation 6.4%. The index of individuality was 0.46, and

the index of heterogeneity was 0.079. These results indicate a marked heterogeneity among subjects. During the first 4 weeks, the mean TRAP value significantly increased at 2 min after cold exposure in the WBC group, returning to baseline 35 min after the exposure. Similar changes were observed in the WS group. However, all changes due to cold were relatively mild (

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The impact of whole-body cryotherapy on parameters of spinal mobility in patients with ankylosing spondylitis

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Background. The aim of our study was to assess the impact of whole-body cryotherapy with subsequent kinesitherapy on spinal mobility parameters in patients with ankylosing spondylitis. Material and methods. We enrolled 32 men with ankylosing spondylitis in a clinical trial. The subjects were randomly divided into 2 groups consisting of 16 persons, with no significant differences in age, duration, or stage of disease, treated with a cycle of 10 whole-body cryotherapy procedures with subsequent kinesitherapy or kinesitherapy alone, respectively. Routine spinal mobility parameters were determined for all patients before and after the end of the therapeutic cycle. Results. Significant improvement of spinal mobility was observed in both groups of patients, but in patients exposed to whole-body cryotherapy with subsequent kinesitherapy the percentage changes in the values of particular parameters were more distinct as compared to patients in whom kinesitherapy alone was used, mainly in respect to lumbar and thoracic spinal mobility. Conclusion. The use of whole-body cryotherapy as a component of comprehensive therapy in patients with ankylosing spondylitis produces significant improvements in spinal mobility parameters as compared to patients in whom kinesitherapy alone is used.

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Monitoring of whole body cryotherapy effects by thermal imaging: preliminary report

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In whole body cryotherapy the whole human body is exposed to low temperature below -100 degrees C in a special room called cryogenic chamber for a very short period of time (2-3 minutes). The impact of cold can cause many different biochemical and physiological reactions of the organism. The skin temperature response due to whole body cryotherapy was studied by means of infrared measurements. The thermograms of chosen body parts of patients suffering from low back pain were performed before and after whole body cooling on the 1(st), 5(th) and the last (10(th)) day of medical treatment. Infrared imaging performed after cold impact owing to the enhancement of the skin temperature profile may reveal a slight decrease of the inflammatory states as a result of the 10 sessions of cryotherapy.

Physica medica : PM : an international journal devoted to the applications of physics to medicine and biology : official journal of the Italian Association of Biomedical Physics (AIFB). 22(2):57-62.

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The assessment of pelvic statics in patients with spinal overload syndrome treated in whole-body cryotherapy

Authors: Zbigniew Sliwiński, Wojciech Kufel, Beata Michalak, Bartłomiej Halat, Wojciech Kiebzak, Magdalena Wilk, Robert Jonak



Background. In pain syndromes involving the lumbo-sacral region, the pelvis, and the lower extremities, the mobility of the hip joint is disrupted by structural and functional changes in tissues, which also cause irritation of the ligaments and muscles of the pelvis. Dislocation of the pelvis with incorrect alignment of the sacroiliac bone leads to an oblique load on the lumbar vertebrae and muscle tension. In recent years whole-body cryotherapy has come to be more and more often applied in the comprehensive treatment of spinal overload syndrome, to reduce pain, relax skeletal muscles, and increase joint mobility. Material and method. The research was conducted in the SP ZOZ outpatient rehabilitation clinic in Zgorzelec, Poland, from December 2004 to March 2005. The study group consisted of 20 persons, 13 women (65%) and 7 men (35%), ranging in age from 23 to 77 years (mean age 47). Each of the subjects received whole-body cryotherapy in a 20-day cycle, once a day for 3 minutes at a temperature of -130 degrees C. The length of the pelvic muscles implicated in overload syndrome, the pain pressure of the pelvic ligaments, the Pidelou test, and Patrick's symptom were assessed before therapy was commenced and after its completion. Immediately after each session the patients received kinesitherapy under supervision of a physiotherapist, Magine exercises, post-isometric relaxation using Mitchel's method for the muscles and the intraspinal, lumbo-sacral and ilio-lumbar ligaments, active of the lumbar spine in the non-painful direction, and neuromobilization using Butler's method. This was supplemented by exercises on the ergometer in horizontal position. Results. Whole-body cryotherapy applied together with kinesitherapy was effective in reducing pressure pain in the ligaments (average 20%) and tension in significant pelvic muscles (average 30%). Conclusions. The cryotherapy and kinesitherapy combination applied to the treatment of spinal overload syndrome gives satisfactory clinical outcome.

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Cryotherapy in osteoporosis

Authors: K Ksiezopolska-Pietrzak



Cryotherapy is use of temperature lower than -100 degrees C onto body surface, for 2-3 minutes, in aim to cause physiological reactions for cold and to use such adapting reactions. Organism's positive response to cryotherapy supports treatment of basic disease and facilitates kinesitherapy. Low temperature may be obtained by use of air flow cooled with liquid nitrogen; this could be applied either locally, over chosen part of the body, or generally, over the whole body, in cryosauna or in cryochamber. The most efficiently is applying cryotherapy twice a day, with at least 3 hours interval. Kinesitherapy is necessarily used after each cryotherapy session. Whole treatment takes 2 to 6 weeks, depending on patient's needs. Cryotherapy reduces pain and swellings, causes skeletal muscles relaxation and increase of their force, also, motion range in treated joints increases. Thus, cryotherapy seems to fulfill all necessary conditions for rehabilitation in osteoporosis. Cryotherapy represents numerous advantages: it takes short time for applying, being well tolerated by patient, also patient's status improves quickly. In addition, contraindications against cryotherapy are rare. All this makes cryotherapy a method for a broad use in prophylactics and treatment of osteoporosis.

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Effectiveness of different cryotherapies on pain and disease activity in active rheumatoid arthritis. A randomised single blinded controlled trial

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OBJECTIVE: Local cryotherapy is used to relieve pain and inflammation in injuries and inflammatory conditions. Whole-body cryotherapy is an extreme method administered at -110 degrees C for 2 to 3 minutes. The aim of the study was to compare the effect of cryotherapies on pain and inflammation in patients with rheumatoid arthritis (RA). **METHODS:** Sixty patients with active seropositive RA were recruited in a randomised controlled single-blinded study to receive whole-body cryotherapy at -110 degrees C, whole-body cryotherapy at -60 degrees C, application of local cold air at -30 degrees C and the use of cold packs locally. In the final analysis, the last 2 groups were pooled. The patients had 2-3 cryotherapy sessions daily for one week plus conventional physiotherapy. Clinical and laboratory variables and patient's and physician's global assessments were used to assess the outcome. Disease activity was calculated by DAS. **RESULTS:** Pain decreased in all treatment groups, most markedly in the whole-body cryotherapy (-110 degrees C) group. DAS decreased slightly with no statistically significant differences between the groups. No serious or permanent adverse effects were detected. Six of 40 patients (15%) discontinued the whole-body cryotherapy. **CONCLUSION:** Pain seemed to decrease more in patients in the whole-body cryotherapy at -110 degrees C than during other cryotherapies, but there were no significant differences in the disease activity between the groups. However, cryotherapy at -110 degrees C is expensive and available only in special centres and may have minor adverse effects. Based on our results, whole-body cryotherapy at -110 degrees C is not superior to local cryotherapy commonly used in RA patients for pain relief and as an adjunct to physiotherapy.

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Cryotherapy

Authors: J Hermann



Cryotherapy is a form of physical therapy that can be applied locally and systemically. Local cryotherapy administered for instance as cold packs, cold air or sprays lowers skin and tissue temperature and subsequently decreases neuronal activity and tissue blood flow. In clinical trials cryotherapy showed analgetic effects and reduced local edema; this treatment is therefore an option in patients with painful and inflammatory rheumatic diseases and after traumatic injuries. Only scant experimental and clinical data are available for whole body cryotherapy at -110 degrees C. The analgetic effects demonstrated so far and the high percentage of adverse events observed with this challenging method currently do not support its routine use in clinical practice.

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Effects of long-term whole-body cold exposures on plasma concentrations of ACTH, beta-endorphin, cortisol, catecholamines and cytokines in healthy females

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OBJECTIVE: Cold therapy is used to relieve pain and inflammatory symptoms. The present study was designed to determine the influence of long-term regular exposure to acute cold temperature. Two types of exposure were studied: winter swimming in ice-cold water and whole-body cryotherapy. The outcome was investigated on humoral factors that may account for pain alleviation related to the exposures. **MATERIAL AND METHODS:** During the course of 12 weeks, 3 times a week, a group of healthy females (n = 10) was exposed to winter swimming (water 0-2 degrees C) for 20 s and another group (n = 10) to whole-body cryotherapy (air -110 degrees C) for 2 min in a special chamber. Blood specimens were drawn in weeks 1, 2, 4, 8 and 12, on a day when no cold exposure occurred (control specimens) and on a day of cold exposures (cold specimens) before the exposures (0 min), and thereafter at 5 and 35 min. **RESULTS:**

Plasma ACTH and cortisol in weeks 4-12 on time-points 35 min were significantly lower than in week 1, probably due to habituation, suggesting that neither winter swimming nor whole-body cryotherapy stimulated the pituitary-adrenal cortex axis. Plasma epinephrine was unchanged during both experiments, but norepinephrine showed significant 2-fold to 3-fold increases each time for 12 weeks after both cold exposures. Plasma IL-1-beta, IL-6 or TNF alpha did not show any changes after cold exposure. CONCLUSIONS: The main finding was the sustained cold-induced stimulation of norepinephrine, which was remarkably similar between exposures. The frequent increase in norepinephrine might have a role in pain alleviation in whole-body cryotherapy and winter swimming.

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Effects of repeated whole-body cold exposures on serum concentrations of growth hormone, thyrotropin, prolactin and thyroid hormones in healthy women

Authors: Juhani Smolander, Juhani Leppäluoto, Tarja Westerlund, Juha Oksa, Benoit Dugue, Marja Mikkelsen, Aimo Ruokonen



Cold therapy is used to relieve pain and inflammatory symptoms. Humoral changes may account for the pain alleviation related to the cold exposures. The aim of the present study was to examine the effects of two types of cold therapy, winter swimming in ice-cold water (WS) and whole body cryotherapy (WBC), on the serum levels of the growth hormone, prolactin, thyrotropin and free fractions of thyroid hormones (fT3, fT4). One group of healthy females (n = 6) was exposed to WS (water 0-2 degrees C) for 20 s and another group (n = 6) to WBC (air 110 degrees C) for 2 min, three times a week for 12 weeks. Blood samples used for the hormone measurements were taken on weeks 1, 4 and 12 before and 35 min after the cold exposures and on the days of the respective weeks, when the cold exposures were not performed. During the WS treatments, serum thyrotropin increased significantly at 35 min on weeks 1 (p < 0.01) and 4 (p < 0.05), but the responses were within the health-related reference interval. During the WS, the serum prolactin measured at 35 min on week 12 was lower than during the control treatment, and no changes in fT3 or fT4 were observed. During the WBC, no changes in the serum levels of the studied hormones were observed during the 12 weeks. In conclusion, repeated WS and WBC treatments for healthy females do not lead to disorders related to altered secretions of the growth hormone, prolactin, thyrotropin, or thyroid hormones.

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Acute whole-body cooling for exercise-induced hyperthermia: a systematic review

Authors: Brendon P McDermott, Douglas J Casa, Matthew S Ganio, Rebecca M Lopez, Susan W Yeargin, Lawrence E Armstrong, Carl M Maresh



OBJECTIVE: To assess existing original research addressing the efficiency of whole-body cooling modalities in the treatment of exertional hyperthermia. DATA SOURCES: During April 2007, we searched MEDLINE, EMBASE, Scopus, SportDiscus, CINAHL, and Cochrane Reviews databases as well as ProQuest for theses and dissertations to identify research studies evaluating whole-body cooling treatments without limits. Key words were cooling, cryotherapy, water immersion, cold-water immersion, ice-water immersion, icing, fanning, bath, baths, cooling modality, heat illness, heat illnesses, exertional heatstroke, exertional heat stroke, heat exhaustion, hyperthermia, hyperthermic, hyperpyrexia, exercise, exertion, running, football, military, runners, marathoner, physical activity, marathoning, soccer, and tennis. DATA SYNTHESIS: Two independent reviewers graded each study on the Physiotherapy Evidence Database (PEDro) scale. Seven of 89 research articles met all inclusion criteria and a minimum score of 4 out of 10 on the PEDro scale. CONCLUSIONS: After an extensive and critical review of the available research on whole-body cooling for

the treatment of exertional hyperthermia, we concluded that ice-water immersion provides the most efficient cooling. Further research comparing whole-body cooling modalities is needed to identify other acceptable means. When ice-water immersion is not possible, continual dousing with water combined with fanning the patient is an alternative method until more advanced cooling means can be used. Until future investigators identify other acceptable whole-body cooling modalities for exercise-induced hyperthermia, ice-water immersion and cold-water immersion are the methods proven to have the fastest cooling rates.

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Can short-term exposure to extremely low temperatures be used as an adjuvant therapy in the treatment of affective and anxiety disorders?

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AIM: The aim of the research was to assess the effect of whole-body cryotherapy (WBCT) on the symptoms observed in a group of patients suffering from affective and anxiety disorders and their own subjective assessment of life satisfaction. **METHOD:** The study group was given short-term exposure (120-180 sec.) to temperatures between -110 degrees C and -160 degrees C on each working day for a period of 3 weeks (a total of 15 treatments). Both the study group (n=26) and control group (n=34) were observed at the beginning and the end of this 3 week interval. Standard psychopharmacological treatment was carried out in both groups, independently of whether cryotherapy was used or not. Hamilton's scales of depression and anxiety were used, together with the life satisfaction scale. **RESULTS:** A statistically significant larger improvement, together with a better mean state after 3 weeks, was observed with respect to 11 of the 14 components of the anxiety scale in the study group compared to the control group (except symptoms associated with the gastrointestinal and genitourinary symptoms and behaviour at interview). A larger improvement, together with a better mean state after 3 weeks, was observed with respect to 12 of the 16 components of the depression scale (except digestive, sexual life hypochondria, body weight and criticism) and 6 of the 11 components of the life satisfaction scale (physical well-being, physical condition, domestic activity, professional activity, personal interests and general satisfaction from life) in the study group. **CONCLUSIONS:** Cyclic short-term whole-body exposition to extremely low temperatures significantly reduced the severity of depressive and anxiety symptoms and increased the life satisfaction.

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The Hottest Method To Cure Pain Is Really An Old, Cold Concept

LOS ANGELES (CBS) — CBS2 and KCAL9 Health Reporter Lisa Sigell finds the hottest thing in the battle against pain is cryotherapy — the use of cold temperatures to shock the body into better health. She even stepped inside a cryo-chamber to give it a try.

It's called the space capsule. It's about seven feet tall. And in this metal chamber is being called by some, the coolest pain treatment of all.

Gus, a patient, is 44, and suffers from rheumatoid arthritis. "So painful. My knuckles hurt, my hands hurt."

He's tried everything. But what really works is twice a day for the past two weeks, he's been stepping into this ice sauna. For about three minutes, nitrogen cools the air to minus 270 degrees Fahrenheit.

What !?

Sigell says it's the ultimate chill out to kill the pain. It's called cryotherapy.

Dr. Jonas Kuehne owns CryoHealthcare. "The extreme cold has an amazing effect on the body."

He says small doses of cold make a big difference.

"The idea is the extremely cold temperatures change the blood chemistry."

Here's how it works: The body thing it's going to freeze, even though it's not. The doctor says the blood rushes to the core where the blood is supercharged with oxygen and nutrients. Once the treatment ends, the blood rushes back through the body to aid in healing. Sigell decided to give it a try. "As your body warms it's not only supposed to ease pain and speed recovery, but also release endorphins, the hormones that elevate your mood."

How did it work? Says Sigell, "I must say, I definitely felt energized all day after the treatment . Even this small machine for specific areas helped my injured ankle for a good week."

The treatment can also be used for anti-aging as it stimulates collagen. Cryotherapy has been around since the 70s. But it is finally getting a lot of exposure. Patients seem to be sold on the cold.

Lisa Sigell, CBS2 News

ESPN on whole-body cryotherapy: Old Mavs, new tricks

This story appears in the July 25, 2011 issue of ESPN The Magazine.

IF IT SEEMED THE OLDEST, MOST INFIRM

among the Mavericks drank from a fountain of youth on their way to snatching this year's NBA title from younger, quicker hands, well, they didn't. Oh, the Mavs found something all right. But it wasn't a fountain as much as a fog. And they didn't drink the rejuvenating potion; they bathed in it. From late April right through to their final championship-clinching victory over the Heat, a sextet of Mavs -- Jason Kidd, Dirk Nowitzki, Jason Terry, Shawn Marion, Tyson Chandler and Brian Cardinal -- made the 20-minute trek from American Airlines Center to a wellness facility in Plano, Texas, two times a week. The grizzled NBA vets, all of whom are 33 or older except for the 28-year-old Chandler, would head to an upstairs room that had all the warmth of a no-frills clinic. They would strip to their underwear and socks, don fleece gloves and, one at a time, step inside a six-foot-tall, padded bluegreen silo that encased them up to their necks (or, in the case of the seven-footers, Nowitzki and Chandler, up to their chests). A large metal bin next to the silo would begin to whirl, and smoky vapor would swirl out of the chamber, as if the players were being cooked in a cauldron.

Actually, they were being frozen. For two and a half minutes -- at a cost of \$75 per person, billed to Mavs owner Mark Cuban -- blasts of nitrogen-chilled air emanated from the walls, quickly dropping the air temperature to as low as -320 degrees Fahrenheit. By the last 30 to 45 seconds, their bodies would be shaking uncontrollably. "The first time Shawn did it, I thought he was going to jump out after 30 seconds," Terry says. "He was yelling, 'My nipples are about to fall off!'"

The regimen is known as cryotherapy, and its devotees say it's an upgrade over the more traditional 15-minute ice bath athletes have long relied on to treat aching joints and muscles. There are, it seems, two problems with ice baths: No. 1, the coldest temperature a person can endure in a bath is 41 degrees; No. 2, when a body is immersed in cold water, it reacts by sending blood to its chilled extremities. But chilling the skin to extreme levels in less than a minute with cryotherapy prompts a different response: The body withdraws the blood to its core in an act of self-preservation. That blood then circulates in a shorter cycle, increasing its nutrients and oxygenation. Once the treatment is finished, this super-enriched plasma returns to the body, flowing first to damaged areas most in need of repair. "It's not going to make you fly out of the room or jump like LeBron James," says Terry of the treatment, "but the feeling you get when you step out of that machine is unbelievable. You feel completely rejuvenated." Cryotherapy's shorter chill time also means muscles and ligaments don't stiffen, and there's less risk of skin damage, according to Eric Rauscher, managing director of Plano's Millennium Ice USA. The modern concept of cryotherapy ("cryo" is Greek for cold) was first developed in the late 1970s in Japan, and cryosaunas have been used in Europe for several decades. Rauscher learned about the device from his Russian father-in-law and brought the first one to the U.S. in 2009. He knew that while the public might not be quick to embrace such a radical treatment, professional sports teams are always looking for an edge.

Hoping to spark interest among local teams, Rauscher made a pitch to Casey Smith, the Mavs' trainer. Smith was concerned about the liability of working with liquid nitrogen and such extreme temperatures. But then April arrived – and with the playoffs looming, an exhausted Kidd looked as if he wouldn't make it to May, missing 12 of 13 shots and scoring a total of three points over the course of back-to-back losses to the Warriors and Trail Blazers. The Mavericks sat him for the next two games. In the meantime, Smith called Rauscher. "I want to come out and bring a player with me," the trainer said.

The 38-year-old Kidd, looking for any edge to help avoid another first-round playoff exit, was that guinea pig. After stepping out of the cryosauna, he said, "That's amazing." Kidd returned two days later with the other thirtysomething Mavs in tow. Each of them took a long look at the machine, then at Kidd. Nowitzki muttered something and went first.

In the end, they all left giddy and convinced.

The next day, the Mavs blistered the Suns by 25 points, and the night after that they beat the Rockets by seven in Houston. In the season finale two days later, Kidd posted his best game in more than a month, outperforming Hornets star Chris Paul with 12 points on four of six threes and eight assists with only one turnover in a 32-point beatdown.

Then in the Finals, Kidd had to defend Dwyane Wade, arguably the most athletic 2-guard in the league, and James, arguably the most athletic player in the league. Kidd gives a big nod to cryotherapy. "I can't take it quite as cold as some of the others," he says. "But it still worked."

Other NBAers, including Manu Ginobili and Kobe Bryant, have also tried the procedure. There are now about 10 cryosaunas in the U.S., including one on the Nike campus near Portland, Ore. -- convenient for Kidd and Co., considering the Trail Blazers were the Mavs' first-round opponent.

"It gave us a tremendous edge, not only physically but psychologically," Terry says.

"I don't know if it was a teambonding thing, but it's something that came up every day. We'd plan on getting together and hitting it. It became a ritual."

And after winning the franchise's first NBA title, the Mavs have no intention of coming in from the cold.

Ric Bucher covers the NBA for ESPN The Magazine.

Nike's new exploration: Cryotherapy

Alberto Salazar has always embraced new technology as a way to minimize injuries, stay on target, and gain a competitive edge.

The altitude tent (and altitude training in general). The Alter-G treadmill. The underwater treadmill. Those are some of the examples.

And now, welcome to the world of cryotherapy.

There is a new thing at Nike called a "Space Cabin", and it is the 21st century's answer to the ice bath. Step inside this metallic cylinder and liquid nitrogen-cooled air (say, 170 degrees below zero) rushes in and cools your skin to a chilly 30 degrees, yet penetrates just a half millimeter. You slowly rotate for two and a half minutes, holding your hands up and out of the freeze, wearing socks on your toes, and at least some underwear to cover your privates.

"It feels like walking out into the coldest day of the year, naked," Salazar said.

Salazar, and Nike, are using this device to cool runners down after workouts. Galen Rupp and Amy Yoder Begley used it last Thursday while I was there. Dathan Ritzenhein (training in Albuquerque last week) was reportedly the first member of the group who agreed to try it.

Ice baths are somewhat painful and lower skin temperature to usually no lower than 50 degrees, according to Millennium Ice representatives on site to supervise training.

The theory behind the cryosauna's use is that it tricks your body into believing it is in serious danger of freezing. The brain sends signals to the rest of the body to draw blood from the extremities and rush it to the core for protection. After you step out, the blood rushes back out again. The phenomena is said to cause an energy boost and skin rejuvenation. It is said to particularly effective to help heal after surgery.

For the sake of athletes, the cryosauna helps sore muscles recover much faster.

Last June, Tyson Gay reportedly used one of the devices to help alleviate his troublesome hamstring.

When you stand inside the chamber, your head remains above the cold air. It's not advisable to breath in the nitrogen, lest it put you to sleep.

Cryotherapy already has numerous medical applications. Athletes who use it may require less down time after workouts, or be able to work harder on back to back days. And it may prevent, or reduce, injuries. And while there are currently less than 20 of them in the U.S., devices like this are apparently the wave of the future. They're more common in Europe, where the technology was developed. But some day soon, I'm told, you might find one at your local spa or country club.

Salazar got linked up with the Millenium Ice folks through Tom Shaw, one of the country's top speed coaches who help NFL prospects prepare for the combine and draft. Shaw is already a big believer.

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Salazar cryosauna

Posted by Peter.Vigneron at 11/06/2010 5:20 PM

By Peter Vigneron, Runner's World

Around 11 a.m. on Saturday Dathan Ritzenhein stepped into a six-foot tall metal cylinder and stood waiting while a Russian man named Aleksandr Matorin filled the chamber with nitrogen vapors super-cooled to minus 275 degrees. Ritzenhein, who was naked but for compression shorts, a hat, gloves, and a pair of socks, will run the New York City Marathon on Sunday, and after a pre-race jog with coach Alberto Salazar on Saturday morning he stopped by Niketown at 57th Street and 5th Avenue for a final cryotherapy treatment before the race.

The cryosauna cools skin to 32 degrees at a depth of around half a millimeter, which gives the body a mild shock and draws its blood supply inward to the vital organs. After two-and-a-half minutes, when the sauna is finished, that blood is supposed to rush back to the muscles, full of oxygen and nutrients, and repair damaged tissue. It is a \$50,000 variation on the ice bath.

"It feels like standing in front of a freezer for a really long time," Ritzenhein said, shortly after Matorin closed the cylinder door. "If you open the door on a hot day? Like that, but a lot colder."

The sauna is Salazar's newest project (he tinkers with unorthodox technologies to a degree that suggests self parody), and Ritzenhein first tried it 12 days ago. Nike purchased a unit for its Beaverton, Ore. headquarters, where Ritzenhein trains, three weeks ago, but Salazar needed a sauna on the east coast in time for the race and asked Millenium Ice, who markets the system, to drive one up from Plano, Texas. Ritzenhein's hotel wasn't sure what to make of the plan, so the sauna ended up in a cramped electrical closet on the sixth floor of Niketown in midtown Manhattan.

"In typical Nike fashion they jumped on it right away," Salazar said. "Of course, they got multiple calls from Nike risk-management lawyers. 'What does this do, who's going in it, what happens if you kill someone?' Very mild frostbite is the worst that you could get."

Ritzenhein was the first of Salazar's athletes to use the sauna, but Kara Goucher, Alan Webb, Galen Rupp, and Amy Yoder Begley have all taken a spin. Lisa Koll, in town to watch training partner Shalane Flanagan race the marathon, tried it on Friday.

Beside the cylinder, there is a large tank of liquid nitrogen and a refrigerator-sized steel rectangle that controls the system's operation. According to Matorin, it uses about as much electricity as a refrigerator, too. Ritzenhein shuffled in circles to keep his feet moving and distribute the nitrogen, which is potentially dangerous if inhaled. The vapors are hundreds of degrees below zero when pumped into the cylinder and cold enough to freeze errant body hair in seconds.

Two-and-a-half minutes later, Ritzenhein was done. "Welcome back home," Matorin said. "The space trip is finished."