Ozone Sauna

Quasi-Total-Body Exposure to an Oxygen-Ozone Mixture in a Sauna Cabin.

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Eur J Appl Physiol Occup Physiol. 1999 Nov-Dec;80(6):549-54.

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We have investigated the effects of quasi-total-body exposure of healthy volunteers to either an oxygen-ozone mixture (O(2)-O(3)) or to oxygen (O(2)) alone during a short period in a sauna cabin. The subjects underwent both an experimental and a control examination, separated by a 3.5-month interval. Body mass, blood pressure, body temperature changes, electrocardiograms, venous blood gas and haemocytometric analyses, total antioxidant status and plasma levels of protein thiol groups, thiobarbituric acid reactive substances (TBARS), plasma cytokine, hepatic enzymes and creatine were determined before, immediately after the 20-min period in the cabin and then 0.5, 1.0 and 24 h afterwards. We observed statistically significant variations of body temperature, venous partial pressure of O(2) values, TBARS and plasma levels of interleukin 8, particularly after O(2)-O(3) exposure. The increase in TBARS plasma levels concomitant with protein oxidation has been tentatively interpreted as being attributable to the transcutaneous passage of some reactive O(2) species, which should be considered if this approach is to be used as a biological response modifier. However, in the present study no adverse effects were noted after one session.

Is it true that ozone is always toxic? The end of a dogma.

Toxicol Appl Pharmacol. 2006 Nov 1;216(3):493-504. Epub 2006 Jun 27.

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There are a number of good experimental studies showing that exposure by inhalation to prolonged tropospheric ozone damages the respiratory system and extrapulmonary organs. The skin, if extensively exposed, may also contribute to the damage. The undoubtful strong reactivity of ozone has contributed to establish the dogma that ozone is always toxic and its medical application must be proscribed. Although it is less known, judiciously practiced ozone-therapy is becoming very useful either on its own or applied in combination with orthodox medicine in a broad range of pathologies. The opponents of ozone-therapy base their judgment on the ozone chemistry, and physicians, without any knowledge of the problem, are often skeptical. During the last 15 years, a clear understanding of the action of ozone in biology and medicine has been gained, allowing today to argue if it is true that ozone is always toxic. The fundamental points that are discussed in this paper are: the topography, anatomical and biochemical characteristics of the organs daily exposed to ozone versus the potent antioxidant capacity of blood exposed to a small and precisely calculated dose of ozone only for a few minutes. It is becoming clear how the respiratory system undergoing a chronic oxidative stress can release slowly, but steadily, a huge amount of toxic compounds able to enter the circulation and cause serious damage. The aim of this paper is to objectively evaluate this controversial issue.

Ozone as Janus: this controversial gas can be either toxic or medically useful.

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Ozone is an intrinsically toxic gas and its hazardous employment has led to a poor consideration of ozone therapy. The aim of this review is to indicate that a wrong dogma and several misconceptions thwart progress: in reality, properly performed ozone therapy, carried out by expert physicians, can be very useful when orthodox medicine appears inadequate. The unbelievable versatility of ozone therapy is due to the cascade of ozone-derived compounds able to act on several targets leading to a multifactorial correction of a pathological

state. During the past decade, contrary to all expectations, it has been demonstrated that the judicious application of ozone in chronic infectious diseases, vasculopathies, orthopedics and even dentistry has yielded such striking results that it is deplorable that the medical establishment continues to ignore ozone therapy.

The ozone paradox: ozone is a strong oxidant as well as a medical drug.

Med Res Rev. 2009 Jul;29(4):646-82. doi: 10.1002/med.20150.

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After five decades characterized by empiricism and several pitfalls, some of the basic mechanisms of action of ozone in pulmonary toxicology and in medicine have been clarified. The present knowledge allows to understand the prolonged inhalation of ozone can be very deleterious first for the lungs and successively for the whole organism. On the other hand, a small ozone dose well calibrated against the potent antioxidant capacity of blood can trigger several useful biochemical mechanisms and reactivate the antioxidant system. In detail, firstly ex vivo and second during the infusion of ozonated blood into the donor, the ozone therapy approach involves blood cells and the endothelium, which by transferring the ozone messengers to billions of cells will generate a therapeutic effect. Thus, in spite of a common prejudice, single ozone doses can be therapeutically used in selected human diseases without any toxicity or side effects. Moreover, the versatility and amplitude of beneficial effect of ozone applications have become evident in orthopedics, cutaneous, and mucosal infections as well as in dentistry.

The Dual Action of Ozone on the Skin.

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Br J Dermatol. 2005 Dec;153(6):1096-100.

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The aim of this brief review is to summarize the recent literature on the effect of ozone (O3) on cutaneous tissues. Recently it has been reported that a chronic contact with O3 can be deleterious for the skin. Our group and others have shown a progressive depletion of antioxidant content in the stratum corneum and this can then lead to a cascade of effects resulting in an active cellular response in the deeper layers of the skin. Using an in vivo model we have shown an increase of proliferative, adaptive and pro inflammatory cutaneous tissue responses. On the other hand the well known activity of O3 as a potent disinfectant and oxygen (O2) donor has been also studied for therapeutic use. Two approaches have been described. The first consists of a quasi-total body exposure in a thermostatically controlled cabin. This treatment has proved to be useful in patients with chronic limb ischemia. The second approach is based on the topical application of ozonated olive oil in several kinds of skin infection (from soreness to diabetic ulcers, burns, traumatic and surgical wounds, abscesses and skin reactions after radiotherapy). We and other authors have observed a striking cleansing effect with improved oxygenation and enhanced healing of these conditions. It is now clear that, on the skin, O3, like other drugs, poisons and radiation, can display either a damaging effect from a long exposure or a beneficial effect after a brief exposure to O2 and O3 or to the application of ozonated oil to chronic wounds.

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Watanabe I, Noro H, Ohtsuka Y, Mano Y, Agishi Y.

Int J Biometeorol. 1997 Apr;40(2):107-12.

The physical effects of negative air ions on humans were determined in an experimental sauna room equipped with an ionizer. Thirteen healthy persons took a wet sauna bath (dry bulb temperature 42 degrees C (107.6 F), relative humidity 100%, 10 min exposure) with or without negative air ions. The subjects were not told when they were being exposed to negative air ions. There were no differences in the moods of these persons or changes in their blood pressures between the two saunas. The surface temperatures of the foreheads, hands, and

legs in the sauna with negative ions were significantly higher than those in the sauna without ions. The pulse rates and sweat produced in the sauna with ions were significantly higher than those in the sauna without ions. The results suggest that negative ions may amplify the effects on humans of the sauna.

Phospholipids under combined ozone-oxygen administration

Muller-Tyl E, Hernuss P, Salzer H, Reisinger L, Washuttl J, Wurst F.
Osterr Z Onkol. 1975;2(4):94-7.

The parenterally application of oxygen-ozone gas mixture gives good results in the treatment of various diseases. Ozone seems to influence the metabolic process of fat, so it was of interest to analyze this influence especially to phospholipids. 40 women with gynecological cancer got 10 ml oxygen-ozone gas mixture with a content of 450 gamma ozone into the cubital vein. Venous blood was removed before and 10 minutes after application and the level of lecithin, lysolecithin, cephalin and spingomyelin was determined by the method of Randerath. A decrease of all four substances was obvious, although all values remained in normal range.

Studies on the Biological Effects of Ozone: 8. Effects on the Total Antioxidant Status and on Interleukin-8 Production.

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Mediators Inflamm. 1998;7(5):313-7.

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Ozone (O3) is a controversial gas because, owing to its potent oxidant properties, it exerts damaging effects on the respiratory tract and yet it has been used for four decades as a therapy. While the disinfectant activity of O3 is understandable, it is less clear how other biological effects can be elicited in human blood with practically no toxicity. On the other hand plasma and cells are endowed with a powerful antioxidant system so that a fairly wide range of O3 concentrations between 40 and 80 microg/ml per gram of blood (approximately 0.83-1.66 mM) are effective but not deleterious. After blood ozonation total antioxidant status (TAS) and plasma protein thiol groups (PTG) decrease by 20% and 25%, respectively, while thiobarbituric acid reactive substances (TBARS) increases up to five-fold. The increase of haemolysis is negligible suggesting that the erythrocyte membrane is spared at the expense of other sacrificial substrates. While there is a clear relationship between the ozone dose and IL-8 levels, we have noticed that high TAS and PTG values inhibit the cytokine production. This is in line with the current idea that hydrogen peroxide, as a byproduct of O3 decomposition, acts as a messenger for the cytokine induction.

Natural ozone scavenger prevents asthma in sensitized rats.

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The assumption that ozone is not only a strong oxidant, but also an important inflammatory mediator, is heavily supported by the ample literature on the pulmonary toxicity and biological effects of environmental ozone and by the recent discovery that antibodies, human neutrophils, and inflammatory lesions catalyze the formation of ozone in vivo. We hypothesized that the pulmonary inflammation in asthma involves a vicious circle of ozone production and recruitment of white blood cells, which produce more ozone. Accordingly, we predicted that electron-rich olefins, which are known ozone scavengers, could be used for prophylactic treatment of asthma. In particular, volatile, unsaturated monoterpenes, could saturate the pulmonary membranes and thereby equip the airways with local chemical protection against either exogenous or endogenous ozone. Here we present experimental evidence using a sensitized rat model to support this hypothesis. Examination of the pulmonary function of sensitized rats that inhaled either limonene (unsaturated, ozone scavenger) or eucalyptol (saturated, inert to ozone) showed that limonene inhalation significantly prevents bronchial obstruction while eucalyptol

inhalation does not cause any effect. The anti-inflammatory effect of limonene was also evident from pathological parameters, such as diminished peribronchiolar and perivascular inflammatory infiltrates.

Effects of ozone on isolated peripheral blood mononuclear cells.

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Toxicol In Vitro. 2005 Feb;19(1):55-61.

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We have investigated the release of cytokines from isolated peripheral human blood mononuclear cells (PBMC) exposed to various ozone concentrations for 10 min and the release of both proinflammatory and immunosuppressive cytokine after 24, 48 and 76 h incubation. Ozonation was performed by exposing for 10 min equal cell numbers and volumes of cell suspension to equal volumes of a gas mixture (1:1 ratio) composed of oxygen-ozone with precise ozone concentrations ranging from 1.0 up to 80 mug/ml (0.02 up to 1.68 mM). Markers of oxidative stress showed a significant relationship between ozone doses and both lipid peroxidation and protein thiol groups content. With the exception of the lowest ozone concentration, the cytokine production of PBMC was depressed particularly at concentrations from 40 mug/ml upwards. There was no significant effect on IL-6 production between exposed or unexposed cells, up to 72 h of incubation. IL-4 production was markedly affected by ozone exposure, showing a marked decrease even at the lowest ozone concentration (2.5 mug/ml) already after 24 h incubation. On the other hand, production of IFN-gamma and TNF-alpha was slightly stimulated by the lowest ozone dose either at all times or only after 72 h incubation, respectively. Analysis of the proliferation index (PI) is consistent with these results showing that, while the lowest concentration stimulates it, progressively increasing O(3) concentrations inhibit the PI. These data show that there is a significant relationship between cytokine production and ozone concentrations and that PBMC are very sensitive to oxidation particularly in presence of serum with low antioxidant capacity.

Effect of Low-Dose Gaseous Ozone on Pathogenic Bacteria.

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Treatment of chronically infected wounds is a challenge, and bacterial environmental contamination is a growing issue in infection control. Ozone may have a role in these situations. The objective of this study was to determine whether a low dose of gaseous ozone/oxygen mixture eliminates pathogenic bacteria cultivated in Petri dishes.

A pilot study with 6 bacterial strains was made using different concentrations of ozone in an ozone-oxygen mixture to determine a minimally effective dose that completely eliminated bacterial growth. The small and apparently bactericidal gaseous dose of 20 μg/mL ozone/oxygen (1:99) mixture, applied for 5 min under atmospheric pressure was selected. In the 2nd phase, eight bacterial strains with well characterized resistance patterns were evaluated in vitro using agar-blood in adapted Petri dishes (105 bacteria/dish). The cultures were divided into 3 groups: 1--ozone-oxygen gaseous mixture containing 20 μg of O(3)/mL for 5 min; 2--100% oxygen for 5 min; 3--baseline: no gas was used.

The selected ozone dose was applied to the following eight strains: Escherichia coli, oxacillin-resistant Staphylococcus aureus, oxacillin-susceptible Staphylococcus aureus, vancomycin-resistant Enterococcus faecalis, extended-spectrum beta-lactamase-producing Klebsiella pneumoniae, carbapenem-resistant Acinetobacter baumannii, Acinetobacter baumannii susceptible only to carbapenems, and Pseudomonas aeruginosa susceptible to imipenem and meropenem. All isolates were completely inhibited by the ozone-oxygen mixture while growth occurred in the other 2 groups.

A single topical application by nebulization of a low ozone dose completely inhibited the growth of all potentially pathogenic bacterial strains with known resistance to antimicrobial agents.

Physical Effects of Negative Air Ions in a Wet Sauna.

Int J Biometeorol. 1997 Apr;40(2):107-12.

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The physical effects of negative air ions on humans were determined in an experimental sauna room equipped with an ionizer. Thirteen healthy persons took a wet sauna bath (dry bulb temperature 42 degrees C, relative humidity 100%, 10 min exposure) with or without negative air ions. The subjects were not told when they were being exposed to negative air ions. There were no differences in the moods of these persons or changes in their blood pressures between the two saunas. The surface temperatures of the foreheads, hands, and legs in the sauna with negative ions were significantly higher than those in the sauna without ions. The pulse rates and sweat produced in the sauna with ions were significantly higher than those in the sauna without ions. The results suggest that negative ions may amplify the effects on humans of the sauna.