A note on ionization of water vs. ionization of air: The ionSpa and similar devices use electrolysis of water to create negative ions which are highly concentrated in a salted bath and compelled by osmosis into the tissue and blood. Air ionizers use electrolysis of air to create negative ions which are then released into the air before being absorbed into the lungs. Despite the inefficiency of air ionization, the benefits are apparent in these studies and are presumably magnified with the greater concentrations found in ion spas.

Effect of Negative Air Ion Treatment on Blood Serotonin in Weather Sensitive Patients

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ABSTRACT. - Positive air ionization elicited by hot dry desert wind spells (Sharav) was found to correlate with blood serotonin in 20 weather sensitive patients increasing from 14-20 mg% to 21-29 mg%. Exposure of 12 of these patients to artificial negative air ionization during 3-6 hours brought blood serotonin back to normal values of 15-20 m% (p,0.001-0.005), while in the 8 control patients, who did not receive the ionising treatment, there remained a high of 21-31 m%. The 12 treated patients had received during 3-6 hours from a grounded ionizer (Modulion) a negative ion load ranging between 2.5 x 105 = 2.5 x 104 ions/cm3/s.

Thus, it can be concluded that increased concentration of positive ions in the air increases blood serotonin levels, whereas negative air ionization neutralizes the effect of positive air ionization and reduces blood serotonin levels to normal values.

INTRODUCTION

The use of negative air ionising apparatuses has increased recently due to the enthusiastic reports of their success in the lay press (Soyka and Edmonds, 1977). Negative air ionization has been progressively introduced in Europe for daily use. It has also been found useful in telephone exchanges, airplane cockpits, post offices, tunnels and buildings where air conditioning may produce a positive ion stream which has to be neutralized by ionizer's with high negative output (Sulman, 1976).

There seems to be no doubt that positive air ionization - in contradistinction to the negative one - produces highly unpleasant reactions due to serotonin release (Krueger, 1972). Weather sensitive people report before the arrival of positive ion rich thunderstorms that they become irritable and anxious, and they may be subject to heart oppression, palpitations, dyspnoe and migraine. Others complain of insomnia, tension, oedemata, rheumatic pain, scar aching, precordial pain, flushes with sweat or chills, vasomotor rhinitis, hyperperistalsis and polakisuria. We were able to show that these complaints are provoked by the prevalence of positive air ions which may completely replace the negative ions. This ion shift to the positive charge releases serotonin (Danon and Sulman, 1969). The passage of hot or cold weather fronts in Israel is characterised by abnormally high counts of positive ions and sferics which provoke the "Serotonin Irritation Syndrome" (SIS) (Sulman et al.,1976). Quantitatively hot fronts excel in high positive ion counts and cold fronts in high sferics counts (Sulman, 1980). In view of these findings we studied the effect of protracted negative air ionization on human blood serotonin and other common blood parameters.

MATERIALS AND METHODS

IONISING APPARATUS. - Negative ions were generated by the Modulion(R) ionizer of Amcor-Amron (Herzliya, Israel) which contains four ionising needles, each with a 5,000v charge. They produce corona discharges each emitting 2.5 x 1011 ions/s/mm3. As a Modulion can be used at a distance of 1-4m, the actual ion density reaching a patient is 2.5 x 105 or 104 ions. The specifications of the apparatus are: 220/240v, 50/60Hz. A control neon light built into the on/off switch flashes to indicate working condition. The 4 needles can be touched without receiving any unpleasant electrical discharge as the short circuit

current on the high voltage side is limited to ,0.1mA. Power consumption is 2W only. Dimensions: length - 14.5cm, width - 9.5cm and height - 7.5cm. Production of ozone and nitrous oxides is reduced to a minimum and at a distance of 10cm ozone could not be traced by 0.05/a Draeger Detection Tubes. Electrically charged aerosols have not been encountered. Design is according to international and European safety standards (VDE, SEV, IEC). the casing of the Modulion is grounded which guarantees a stable and continuous ion flux.

Measurements of ions, sferics and electrofields were carried out using the method of Sulman et al., 1976. They showed that weather sensitive patients suffered only from changes in ion and sferics counts, not, however, from extreme fluctuations of the electrofields.

PATIENTS. - Twenty weather sensitive patients suffering from incoming hot weather fronts were chosen for the present study. They comprised 12 females and 8 males. Their sufferings began 24-48 hours before the arrival of the weather front, thus stressing the medical importance of the weather front which precedes the actual weather change. The complaints included typical symptoms of the Serotonin Irritation Syndrome (SIS), as described by Danon and Sulman, 1969, such as migraine, multiple oedemata of face (Quincke), fingers or legs, heart palpitations, dyspnoe, hot flushes with sweat or chills, vasomotoric rhinitis resembling hay fever, conjunctivitis resembling conjunctivitis vernalis, rheumatic pain of the extremities, hyperperistalsis resulting in multiple defecation and polakisuria including hourly micturition. SIS sufferings could be predicted by our daily monitoring of air ions, sferics and electrofields during the 3 Sharav months March April May 1979. When the patients complained of SIS symptoms 24-48 hours before the arrival of the weather front - 10ml of blood were taken to measure blood serotonin at zero hour (Sample I), and again on the arrival of the weather front 1-5 hours later (Sample II). Then 12 of the patients were exposed to negative air ionization, which could be discontinued after 3-6 hours, as all of them reacted favorably; the remaining 8 patients who served as controls were not given negative air ionization. Subsequently, 10ml of blood were again taken from all patients including the controls for comparison at different time intervals (Sample III).

IBLOOD ASSAYS. - Blood serotonin was assayed according to Yuwiler et al., 1970: 5ml blood were transferred to a tube containing 0.06ml of a K3 EDTA solution with 0.2mg/ml of potassium sorbate. To avoid serotonin destruction or release from thrombocytes the tube was gently inverted and placed on ice until used. Another 5ml of coagulated blood were transferred to a sequential multiple analyzer (SMA) for determination of sodium, potassium, CO2, chloride, glucose, urea nitrogen, cholesterol, total protein, albumin, total bilirubin alkaline phosphatase and serum glutamine oxaloacetic transaminase (3GOT). 5-HIAA was not assayed since its blood level is too low to allow exact determinations.

RESULTS

Table 1 shows the results obtained with the 20 patients studied, 12 of whom were exposed to 3-6 hours of negative air ionization during an incoming Sharav weather front and 8 of whom had a dummy apparatus switched on for control. The cases selected were those where positive air ionization preceding a weather front would allow prediction of their typical manifestation of a serotonin reaction. In all cases blood serotonin values were within normal range when patients came in (14-20 mg)% (SE + 1.7)*. These rose, however, within 2 days with the arrival of the weather front, ranging between 21-29mg% (SE + 1.8)* and decreased on the third day to 14-20mg% (SE + 2)* following ionising treatment. In the controls, (i.e., no negative ions) high values of blood serotonin (28-29mg%) (SE + 1.9)* persisted as long as the Sharav lasted (1-2 days).

* The SE values compared well with the daily exercise of our laboratory where hundreds of such examinations are carried out for 10 years

There were no changes in the other blood parameters studied, viz. sodium, potassium, CO2, chloride, glucose, urea nitrogen, cholesterol, total protein, albumin, total bilirubin, alkaline phosphatase and serum

glutamic oxaloacetic transaminase (SGOT): they were normal before the ionization treatment and remained so after the treatment.

DISCUSSION

The technique of Yuwiler et al (1970) used here prevents serotonin loss as well as serotonin release from thrombocytes by blood manipulation. It is also not dependent on fasting or ingestion of serotonin rich food, eg bananas. Its SE is extremely low + 1.8 - 2.*

The effect of an increased concentration of positive ions in the air on serotonin release confirms the findings of Krueger, Hicks and Beckett (1963) and Sulman, Levy, Lewy et al. (1974). The opposite effect of negative air ionization on serotonin release and destruction has been shown in man by Danon and Sulman (1969) and in vitro by Tal. Pfeifer and Sulman (1976). It is noteworthy that the patients' complaints of SIS appeared already before serotonin levels were maximally increased. This may be due to normal breakdown of 5-HT to 5-HIAA which was overridden when positive air ionization became excessive.

The site of serotonin release is probably mainly the hypothalamus which is the sensor of heat stress effects. Participation of the carotid body has been mooted by Behar et al. (1979). The involvement of the enterochromaffine cells would elicit much higher values than those encountered here.

The fact that negative air ionization over 3-6 hours did not influence blood chemical components is noteworthy, however more study should be devoted to this finding using negative ionization for 24 hours, a period which has been shown by us to be free of harmful side effects (Sulman et al., 1978). Russian investigators cited in a NASA report (1966) claimed that negative air ions may cause a decrease in elevated blood cholesterol - a finding not yet closely studied.

REFERENCES

1. BEHAR, AJ DEUTCH, E., POMERANTZ, E., PFEIFER, Y and SULMAN, FG (1979): Migraine, serotonin and the carotid body. Lancet i: 550-551.
2. DANON, A. and SULMAN, FG (1969): Ionising effect of winds of ill repute on serotonin metabolism. Biometeorology 4. (Suppl. to Int. J. Biometeor.) 4 - Part II 135-136.
3. KRUEGER, AP (1972): Are air ions biologically significant? A review of a controversial subject. Int. J. Biometeor., 16: 313-322.
4. KRUEGER, AP., HICKS, WW and BECKETT, JC (1963): Influence of air ions on certain physiological functions. In Medical Biometeorology. SW Tromp (ed.). Elsevier Publ. Comp., Amsterdam, 351-369.
5. NASA (1966): The aero-ionic composition of pressurised cabin air and its influence on the human body. Soviet Congress on Space Biol. & Med. Moscow. 10 Nov. 1966.
6. SOYKA, F. and EDMONDS, A. (1977): The Ion Effect. Dutton & Co. Publ. N.Y., 181pp. SULMAN, FG (1976): Health, Weather and Climate. Karger, Basel, 160pp.
7. SULMAN, FG (1980): The Effect of Air Ionization, Electric Fields, Atmospherics and other Electric Phenomena on Man and Animal. Charles C. Thomas, Springfield, III., 400pp.
8. SULMAN, FG., DANON, A., PFEIFER, Y., TAL., E. and WELLER, CP (1970): Urinalysis of patients suffering from climatic heat stress (Sharav). Int. J. Biometeor., 14: 45-53.
9. SULMAN, FG., LEVY, D., LEWY., PFEIFER, Y., SUPERSTINE, E. and TAL, E. (1974): Air ionmetry of hot, dry desert winds (sharav) and treatment with air ions of weather sensitive subjects. Int. J. Biometeor., 18: 313-318.
10. SULMAN, FG., LEVY, D. and LUNKAN, L (1976): Wetterfuehligkeit und ihre Beziehung zu Sferics, Ionen und Electrofeldern. Z. Physik. Medizin 5: 229-238.
11. SULMAN , FG., LEVY, D., LUNKAN, L., PFEIFER, Y. and TAL, E. (1978): Absence of harmful effects of protraced negative air ionization. Int. J. Biometeor., 22: 53-59.

12. TAL, E., PFEIFER, Y. and SULMAN, FG (1976): Effect of air ionization on blood serotonin in vitro. Experienta (Basel) 32: 326-327.
13. YUWILER, A., PLOTKIN, S., GELLER, E. and RITVO, EG (1970): A rapid accurate procedure for the determination of serotonin in whole human blood. Biochem. Med. (USA) 3: 426-436.