WHAT IS HYDROGEN?

- Hydrogen is the element with atomic number 1 in the periodic table.
- It is the lightest / smallest chemical element and the most common element in the universe.
- Hydrogen water has got antioxidant capabilities with some adventages if it was compared with other antioxidant with known Brand names.



GLOSARY

OXIDANT:

An **oxidant** is a reactant that oxidizes or removes electrons from other reactants during a chemical reaction. (free radicals, They use to be reactants that include Oxigen...)

OXIDATION:

Oxidation is the loss of electrons during a reaction by a molecule, atom or ion.

The stable molecule that is oxidized (an electron was stolen) by a free radical, becomes into **unestable** one (new free radical), due to it has got an electron less. This gets a chain reaction damaging other molucules, cell membranes This process gets an acid behaviour.

A **REDUCTANT (ANTIOXIDANT)** IS THE OPPOSITE OF AN OXIDANT **REDUCTION** IS THE OPOSITE OF OXIDATION.





REDUCTANT / ANTIOXIDANT giveseelectron OXIDANT / FREE RADICAL. steals e-

REDOX REACTION

ORP (Oxidation & Reduction Potential)

ORP IS is a measure of the tendency of a chemical species to acquire electrons and thereby be reduced.

A flow of electrons is a electric current (Amperes). More or less tendency to get this electrical flow between two points is related with electric Voltage (Volts). **ORP unit is mV. (miliVolts)**

If ORP is **positive** then means the substance is **oxidant**; If ORP is **negative** then means the substance is redutant = **antioxidant**.

The higher the H2 concentration in water is, the more negative the ORP is. (it depends on the feed water characteristics) The lower the H2 concentration in water is, the less negative the ORP is.









FREE RADICAL FORMATION

What are free radicals?

- Free Radicals = atoms / molecules / ions... with an unpaired electron at least. They try to get more stability catching 1 electron from other molecules around them. Then, these molecules are oxidated and become into a new free radical.
- They are one of the responsible sources of the cell **oxidation** in our body.

• Oxidative stress = accumulation of different kind of free radicals in our body. It is related to some diseases and some processes that can generate them.





Just by living our bodies oxidise. Scientists have found that the oxygen which acts in our metabolism generates free radicals. They are molecules which lack electrons and so, they steal them from other molecules causing damages in different cellular structures such as DNA.

Oxidative Stress (Free Radical accumulation) is related to a lot of diseases and the processes that generated them.

Where do free radicals come from?

- **INTERNAL:** they are generated by our own body. It used them to get a balanced metabolic proceesses, subproducts from mitochondrias when they generated energy...
- **EXTERNAL:** they are generated by some kind of meal, tobacco, alcohol, pollution, sun, exhaustive sport..... Processes that increases the oxygen consumption...
 - If accumulation in the body: Oxidative Stress.
 - No all oxidants are bad and they must be removed. Our body and cells needs a minimum amount of oxidants to keep alive and do metabolic processes properly.
 - If all oxidants were removed from our body we would die.



Which cellular damages may they trigger?

- DNA damages (genetic).
- Damage to the immune system.
- Premature ageing.
- Inflammatory conditions.
- Other various illnesses

Why do they occur?

- Smoking.
- Atmospheric pollution.
- Inflammation.
- UV radiation.
- lonising radiation.



Oxidative stress

- ~ Own metabolism.
- ~ Intense sport.
- ~ Air pollution.
- CAUSES ~ Type of diet.
- ~ Ultraviolet radiation.
 - ~ lonising radiation.
 - ~ Others.
 - ~ Possible non-hereditary genetic damage.
 - ~ Possible damage to the immune system.
- ~ Inflammation.
- ~ Premature ageing.
- ~ Others.

CONSEQUENCES

ACCORDING TO RESEARCHERS, THE FOLLOWING DISEASES MAY BE INFLUENCED BY OXIDATIVE STRESS.



How to work against?





So then, is the antioxidant consumption important for the health?

Getting enough amount of antioxidant in our body is important, furthermore in case of being exposed to the factors that generates free radicals, like stress.

If high levels of free radicals in our body for a long time, they would cause muscle fatigue, skin or hair damage, en la piel y el cabello, weaking of the immune system....

Why? As the more oxigen (O2) is processed by the body, the more free radicals are generated and then the more antioxidant would needed to neutralize them.

The more time we are exposed to factors that generated free radicals, the more consumption of antioxidant is required.

Oxidative stress reduce the synthesis of collagen and ellastin, generating expresion marks and lines. Working against free radicals, antioxidants can help to prevent some visible signs of aging.











A way to neutralize free radical accumulation, is eating and taking antioxidant foods and products.

ANTIOXIDANTS:

- Hydrogen water .
- Vitamin C.
- Vitamin E.
- Catechin.
- Coenzyme Q10.
- Lycopenes.
- Resveratrol.
- Glutathione.
- Sulforane.
- Quercitine.
- Superoxide dismutase.
- Peroxidase.
- Lipoic acid.
- Uric acid.
- Carotene (l).
- Catalase.

Drinking 1.5 litres of hydrogen water provides an **ANTIOXIDANT** power equivalent to consuming:



If 1000 ppb [H2] in water

ADVENTAGES OF HYDROGEN WATER

- Checked antioxidant capability.
- Moderate antioxidant. It is not the most powerfull.
 - Cells need a mínimum level of oxidants to survive.
 - A powerful anti-oxidant would reduce too much the level of Oxidants.
- Without side effects nor chemical waste. No toxic.
 - H2 without maxium dosis.
 - (The limit is the volumen of water to be drunk per day).
 - Without a chemical waste to be removed after reaction.
- High abitity diffusion and penetration in human body and cells.
 - H2 is a small molecule compared with other antioxidant.
 - It can pass through different kind of cells and organs. (kidney, liver, brain....)
 - C Vitamin is **water-soluble.** It can only work in organs with a high percentage of water in and low percentage of fat like kidney....
 - E, D vitamins are **fat-soluble**. It can only work in organs with a highg percentage of fat, like liver...
- Easy to be taken.
 - More than 1,5 3 mg of H2 per day is recomented to be taken.
 - Units that dispense 1 ppm of H2 in water. So it can be got drinking 1,5...3 liters per day.
- Selective and efective.
 - It can neutralice cytotoxic free readical and Hidroxile ion (OH-). Nature says.



OTHER ANTIOXIDANTS. (They cannot go through and reach easily the tissues).

HYDROGEN. It does easily reach the tissues



You can take Hydrogen when antioxidants were recommended.



- Wrinkles.
- Cystitis.
- Allergies of type 1.
- Fibrogenesis.
- Combats endotoxins.
- Helps in recovery after smoke inhalation.
- Regulates and normalises the parameters of metabolic syndromes.
- Helps in hyperlexia.
- Peridontitis.
- Gastric ulcer.
- Ulcerative colitis.
- Erectile dysfunction.
- Osteoporosis.
- Muscle fatigue.
- Metabolic acidosis.
- Asthma.
- Neonatal hypoxia.
- Carbon monoxide poisoning.
- Extension of the lifespan.
- Sperm mobility.
- Fibromyalgia.

STUDY PUBLISHED IN NATURE.

Hydrogen acts as a therapeutic antioxidant by selectively reducing cytotoxic oxygen radicals.

Ikuro Oshawa et al.

Acute oxidative stress induced by ischemia-reperfusion or inflammation causes serious damage to tissues, and persistent oxidative stress is accepted as one of the causes of many common diseases including cancer.

We show here that hydrogen has potential as an antioxidant in preventive and therapeutic applications. We induced acute oxidative stress in cultured cells by three independent methods. Hydrogen selectively reduced the hydroxyl radical, the most cytotoxic of reactive oxygen species (ROS), and effectively protected cells; however, hydrogen did not react with other ROS, which possess physiological roles. We used an acute rat model in which oxidative stress damage was induced in the brain by focal ischemia and reperfusion.

The inhalation of H₂ gas markedly suppressed brain injury by buffering the effects of oxidative stress. Thus H₂ can be used as an effective antioxidant therapy; owing to its ability to rapidly diffuse across membranes, it can reach and react with cytotoxic ROS and thus protect against oxidative damage.

medicine

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Hydrogen acts as a therapeutic antioxidant by selectively reducing cytotoxic oxygen radicals

Ikuroh Ohsawa¹, Masahiro Ishikawa¹, Kumiko Takahashi¹, Megumi Watanabe^{1,2}, Kiyomi Nishimaki¹ Kumi Yamagata¹, Ken-ichiro Katsura², Yasuo Katayama², Sadamitsu Asoh¹ & Shigeo Ohta¹

Acute oxidative stress induced by ischemia-reperfusion or inflammation causes serious damage to tissues, and persistent oxidative stress is accepted as one of the causes of many common diseases including cancer. We show here that hydrogen (H2) has potential as an antioxidant in preventive and therapeutic applications. We induced acute oxidative stress in cultured cells by three independent methods. H₂ selectively reduced the hydroxyl radical, the most cytotoxic of reactive oxygen species (ROS), and effectively protected cells; however, H2 did not react with other ROS, which possess physiological roles. We used an acute rat model in which axidative stress damage was induced in the brain by focal ischemia and reperfusion. The inhalation of H₂ gas markedly suppressed brain injury by buffering the effects of oxidative stress. Thus H2 can be used as an effective antioxidant therapy; owing to its ability to rapidly diffuse across membranes, it can reach and react with cytotoxic ROS and thus protect against oxidative damage.

Oxidative stress arises from the strong cellular oxidizing potential of **RESULTS**

excess reactive oxygen species (ROS), or free radicals1-5. Most of the superoxide anion radical (Op+) produced is generated in mitochondria by electron leakage from the electron transport chain and the Krebs cycle⁶. O₂^{*} is also produced by metabolic oxidases, including NADPH oxidase and xanthine oxidase⁷. Superoxide dismutase converts Oy* into hydrogen peroxide (H2O2)8, which is detoxified into H2O by either glutathione peroxidase or catalase. Excess O7* reduces transition metal ions such as Fe3+ and Cu2+ (ref. 2), the reduced forms of which in turn can react with H₂O₂ to produce hydroxyl radicals (*OH) by the Fenton reaction. "OH is the strongest of the oxidant species and reacts indiscriminately with nucleic acids, lipids and proteins. There is no known detoxification system for *OH; therefore, scavenging *OH is a critical antioxidant process9.

Despite their cytotoxic effects, O2* and H2O2 play important physiological roles at low concentrations: they function as regulatory signaling molecules that are involved in numerous signal transduction in culture medium did not decrease MiteSOX and DCF signals in cascades and also regulate biological processes such as apoptosis, cell the cells (Fig. 1a,b and Supplementary Fig. 1). Additionally, H2 proliferation and differentiation⁵²⁰. At higher concentrations, H2O2 is did not decrease the steady-state level of NO* (Supplementary converted into hypothlorous acid by myeloperoxidase; hypothlorous Fig. 1). In contrast, H2 treatment significantly decreased levels acid definds against bacterial invasion⁵. Nitric oxide (NO*), another of *OH, as assessed by the fluorescence signal emitted by the oxi-ROS, functions as a neurotransmitter and is assential for the dilation of dized form of 2-[6-(4'-hydroxy)phenoxy-3H-xanthen-3-on-9-yl] blood vessels11. Thus, cytotoxic radicals such as *OH must be neu- henzoate (HPF) (refs. 14,15 and Fig. 1c,d). When we exposed traliaed without compromising the essential biological activities of the cells to antimycin A (50 µg/ml) in the absence of H₂, the HPP other, physiologically beneficial, ROS. Here we demonstrate that molecular hydrogen (dihydrogen, H2) can alleviate *OH-induced cytotoxicity without affecting the other ROS, and propose that H2 has potential *OH. Notably, H2 decreased *OH levels even in the nuclear as an antioxidant for preventive and therapeutic applications.

H₂ selectively reduces +OH in cultured cells

H2 reduces the *OH that is produced by radiolysis or photolysis of water12; however, whether H2 can effectively neutralize *OH in living cells has not been directly investigated. As the cellular damage produced by spontaneous generation of *OH is not sufficient to be detectable, we induced O7* production in PC12 cultured cells. To do this, we treated the cells with a mitochondrial respiratory complex III inhibitor, antimycin A (ref. 13); following such treatment, O5* in these cells is rapidly converted into H₂O₂. The addition of antimycin A increased levels of Og* and H2O2, as judged by the fluoresource signals emitted by the oxidized forms of MitoSOX (Fig. 1a) and 2',7'-dichlorodihydrofluorescein (H2DCF) (Supplementary Fig. 1 online), respectively. We dissolved H2 and O2 into medium as described in the Methods, and confirmed the prolonged (24 h long) maintenance of H2 levels (Supplementary Fig. 2 online). H2 dissolved signals increased in both the nuclear region and the cytoplasm, probably because H2O2 diffused from the mitochondria to produce region (Fig. 1c).

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SOME STUDIES ABOUT HYDROGEN AND THE BRAIN (I).

 Pilot study of H₂ therapy in Parkinson's disease: a randomized double-blind placebo-controlled trial. Conclusions: <u>H₂ therapy improved the disease in this pilot study.</u> Authors: Un Yuritaka, Takanashi, Hirayama, Ohta, Hattori. Published in 2013.

2. Consumption of molecular hydrogen prevents the stress-induced impairments in hippocampus-dependent learning tasks during chronic physical restraint in mice.

Conclusions: <u>The continuous consumption of hydrogen water reduces oxidative stress in the brain, and</u> prevents the stress-induced decline in learning and memory caused by chronic physical restraint. Authors: Nagata, Nakashima-Kamihura, Mukami, Ohsawa, Ohta. **Published by: Neuropsychopharmacology (Nature Publishing Group), 2009.**

3. Drinking hydrogen water ameliorated cognitive impairment in senescence-accelerated mice. Authors: Gu, Huang, Inoue, Yamasita, Ishida. Published by: J. Clin. Biochem. Nutri. 46, 2010.

<u>Hydrogen in drinking water reduces dopaminergic neuronal loss</u> in the 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine mouse model of Parkinson's disease.
 Authors: Various. Edited at Cambridge University.

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- Hepatic oxidoreduction-related genes are upregulated by administration of hydrogen-saturated drinking water. Authors: Nakai, Sato, Okada et al. Published by: ISB1, 2011
- 2. Hydrogen-rich water protects against acetaminophen-induced hepatotoxicity in mice. Authors: Zhang, Dong Song, Pang et al. Published by: World Journal of Gastroenterology, 2015
- 3. Inhalation of hydrogen gas suppresses hepatic injury caused by ischemia/reperfusion through reducing oxidative stress.

Authors: Fukua, Asoh, Ishikawa et al. Published by: Biochemical and Biophysical Research Communications, 2007.

- 4. <u>Hydrogen-rich saline ameliorates the severity of L-arginine-induced acute pancreatitis</u> in rats. Authors: Chen, Sun, Li, Liu et al. <u>Published by: Barc Elsevier, 2010.</u>
- 5. Effects of hydrogen-rich saline on taurocholate-induced acute **pancreatitis** in rats.

Conclusion: hydrogen reduces inflammation and acute effects.

Authors: Zhang, Feng Chen. Published by: Hindawi Publishing Corporation, 2013.

6. Hydrogen-rich saline inhibits NLRP3 inflammasome activation and <u>attenuates experimental acute pancreatitis</u> in mice.

Authors: Ren, Ha, Hou et al. Published by: <u>Hindawi Publishing Cor</u>poration, 2014.

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1. Hydrogen-supplemented drinking water protects cardiac allografts from inflammation-associated deterior

Authors: Noda, Tanaka, Shigemura, Kawamura, Wang, Masutani, Sun, Toyoda, Bermudez, Nakao. Published by: Transplant International, 201

2. Consumption of hydrogen water prevents atherosclerosis in apolipoprotein E knockout mice.

Authors: Ohsawa, Nishimaki, Yamagata et al. Published by: Elsevier, 2008.

3. Inhalation of hydrogen gas reduces infarct size in the rat model of myocardial ischemia-reperfusion injury. Authors: Hayashida, Sano, Ohsawa et al. **Published by: Elsevier, 2008.**

4. Hydrogen gas protects against serum and glucose deprivation induced myocardial injury in H9c2 cells through activation of the NF-E2-related factor 2/heme oxygenase 1 signalling pathway.

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Authors: HHayashida, Sano, Kamimura et al. Published by: American Heart Association, 2014.

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1. Transperitoneal administration of dissolved hydrogen for peritoneal dialysis patients: a novel approach to suppress oxidative stress in the peritoneal cavity.

Authors: Terawaki, Hayashi, Zhu et al. Published by: Medical Gas Research, 2014.

- 2. Oral hydrogen water prevents chronic allograft nephropathy in rats. Authors: Cardinal, Zang, Sugimoto et al. Published by: International Society of Nephrology, 2009.
- 3. Reduced hemodialysis-induced oxidative stress in end-stage renal disease patients by electrolyzed reduced water.

Authors: Huang, Yang, Lee et al. Published by: Kidney International, 2003.

4. Protective effect of hydrogen-rich water against gentamicin-induced nephrotoxicity in rats using blood oxygenation level-dependent MR imaging.

Authors: Kusakabe, Matsushita et al. Published by: Magn. Reson. Med. SCF., 2011.

- Intake of water with high levels of dissolved hydrogen (H2) suppresses ischemia-induced cardio-renal injury in Dahl salt-sensitive rats. Authors: Zhu, Nakayama, Huri et al.
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- 6. Hydrogen-rich saline attenuates ischemia-reperfusion injury.

Authors: Singhu, Kuga, Hagiwara et al. Published by: Japanese Society of Anesthesiologists, 2010.

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- Suppressive effects of electrolyzed reduced water on alloxan-induced apoptosis and type 1 diabetes mellitus. Authors: Li, Hamasaki, Nakamichi et al. Published by: Cytotechnology, 2011.
- "Nordenau Phenomenon" Application of natural reduced water to therapy. <u>411 diabetes patients drinking natural reduced hydrogen water from Nordenau (Germany) for 6 days improved their metabolic parameters</u>. Authors: Gadek, Hamasaki.
- 3. Supplementation of hydrogen-rich water improves lipid and glucose metabolism in patients with type 2 diabetes or impaired glucose tolerance.

Authors: Kajiya Haab, Hase Gawab, Asanub, Hosodab et al. Published by: Nutrition Research, 2008.

- 4. <u>Anti-diabetic effects of electrolyzed reduced water</u> in streptozotocin-induced and genetic diabetic mice. Authors: Kim HJ, Kim HK. **Published by: glowing-health.com**
- 5. Hydrogen improves glycemic control in type 1 diabetic animal model by promoting glucose uptake into skeletal muscle.

Authors: Amitani, Asakawa et al. Published by: Plos One, 2013.

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1. Hyperbaric hydrogen therapy: a possible treatment for cancer.

Authors: Dole, Wilson, Fife. Published by: Science, 2008.

Inhibitory effect of electrolyzed reduced water on tumor angiogenesis.

Authors: Ye, Li, Mamasaki et al. Published by: Biol. Pharm. Bull., 2008.

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 Conclusions: ROS (Reactive Oxygen Species) contribute to carcinogenesis and to tumor progression: altering the redox and the intracellular ROS can have profound effects on pro-metastatic signalling pathways.

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4. Oxidative stress and nerve damage: role in chemotherapy induced peripheral neuropathy.

Authors: Areti, Yerra, Naidu, Kumar. Published by: Elsevier - Redox Biology, 2014.

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Authors: Ishikawa et al. Published by: Science, 2008.

6. Molecular hydrogen alleviates nephrotoxicity induced by an anti-cancer drug cisplatin without compromising anti-tumor activity in mice.

Authors: Nakashima, Kamimura, Mori, Oshawa, Asom. Published by: Cancer Chemother Pharmacol., 2008.

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Bad cholesterol:

1. Molecular hydrogen attenuates fatty acid uptake and lipid accumulation through downregulating CD36 expression in HepG2 cells.

 Authors: Lio, Ito, Ito, Ito et al.
 Published by: Medical Gas Research, 2013.

2. Hydrogen-rich water decreases serum LDL-cholesterol levels and improves HDL function in patients with potential

metabolic syndrome. Authors: Song, Li, Sang et al. Published by: JLR Papers, 2013.

Intestine:

1. Luminal injection of hydrogen-rich solution attenuates intestinal ischemia-reperfusion injury in rats. Authors: Sigetha, Sakamoto, Li et al. **Published by: Basic and Experimental Research, 2014.**

 2. Hydrogen inhalation ameliorates oxidative stress in transplantation induced intestinal graft injury.

 Authors: Buchholz, Kazzurowki et al.
 Published by: American Journey or Transplantation, 2008.

3. Dose-dependent inhibition of gastric injury by hydrogen in alkaline electrolyzed drinking water.

Authors: Xue, Jang, Tanaka et al. Published by: BHC Complementary and Alternative Medicine, 2014.

Extension of the lifespan:

 I. Extension of the lifespan of Caenorhabditis elegans by the use of electrolyzed reduced water.

 Authors: Xan, Tian et al.
 Published by: ISBA, Biosci. Biotech. Biochem, 2010.

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 I. Protective effects of hydrogen-rich saline in uncontrolled haemorrhagic shock.

 Authors: Du, Jia, Liu et al.
 Published by: Experimental and Therapeutic Medicine, 2014.

SOME STUDIES ABOUT HYDROGEN AND THE SKIN.

- Improvement of psoriasis-associated arthritis and skin lesions by treatment with molecular hydrogen: A report of three cases

 Authors: Ishibashi, Ichikawa, Sato et al.
 Published by: Molecular Medicine Report, 2015.
- The drinking effect of hydrogen water on atopic dermatitis induced by Dermatophagoides Farinae allergen in mice. Authors: Rosa M., Ç. Ignacio, Kwak, Yun et al. Published by: Hindawi Publishing Corporation, 2013.
- **3.** Atomic hydrogen surrounded by water molecules modulates basal and UV-induced gene expressions in human skin cells.

Conclusions: Hydrogen water may prevent UV-induced skin inflammation and can modulate intrinsic skin ageing and photoageing processes.

Authors: Shin, Park, Nojima et al. Published by: Plos One, 2013.

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Authors: Li, Kato, Matsouka et al. Published by: Medical Gas Research, 2013.

- 5. Hydrogen-rich warm water represses wrinkle formation against UVA rays, together with type-I collagen production and oxidative stress diminishment in fibroblasts and cell-injury prevention in keratinocytes.
 Authors: Kato, Saitoh, Inai et al. Published by: Journal of Photochemistry and Photobiology, 2011.
- 6. Positive effects of hydrogen water on dinitrochlorobenzene-induced atopic dermatitis in NC/Nga Mice. Authors: Yoon, Easter Joy, Rosa M., Coles et al. Published by: The Bio. Pharma. Bull., 2014.



Universidad Nacional Autónoma de México

Antioxidant effects of reduced water produced by electrolysis and with hydrogen.

The use of antioxidants to prevent damages related to oxidative stress is of great importance. It has been shown that reduced water produced by electrolysis reduces oxidative stress and the damages related to a number of different experimental pathologies in patients undergoing haemodialysis. Further information in http://www.journals.unam.mx



Oxidative damage is defined as the bimolecular damage caused by the attack of reactive species upon the constituents of living organisms. This damage is associated to many degenerative diseases such as Alzheimer, cancer, diabetes, atherosclerosis and many others. In this context the use of antioxidants to prevent the damage induced by oxidative stress is of great importance. **Source: http://aguahidrogenada1.blogspot.com.es**



Clinical Effects of Hydrogen Administration.

Molecular hydrogen has proven useful and convenient as an antioxidant and modifier of gene expression in many conditions where oxidative stress and changes in gene expression result in cellular damage. Source: http://acceso.siweb.es/content/978795/hydrogen_efectos_clinicos.pdf



Dos Campus d'Excel·lència Internacional:





- Grup de Transport i Vehiculació de Fàrmacs Departament de Bioquímica i Biologia Molecula Eacultat de Biologia Ionfilter. Tratamientos del Agua VDF S.L. Estudio in vitro del efecto citotóxico y antioxidante de un agua hidrogenada sobre líneas celulares humanas. BARCELONA B:KC Edifici Antoni Prevosti, planta -1 Av. Diagonal, 643 C.P.08028 Barcelona (Espanya) Tel. 93 402 12 14 e-mail:jcdomingo@ub.ed
- H2 WATER **IS NOT TOXIC** FOR HUMAN.
- ANTIOXICANT CAPACITY OF THE HYDROGEN (H2) INSIDE CELLS IS CONFIRMED TECHNICALLY.
- H2 IS NOT A POWERFULL ANTIOXIDANT.
 CELLS NEED A MINIMUM QUANTITY OF OXIDANT AND FREE RADICALS TO LIVE AND SURVIVE.

(OTHER POWERFULL ANTIOXIDANT CAN REACT, REDUCING FREE RADICALS TOO MUCH). H2 HAS GOT THE ABILITY TO REACT WITH CITOTOXIC FREE RADICAL. FREE RADICALS THAT CAN DAMAGE CELULAR MEMBRANES)

• H2 HAS GOT A VERY **EASY DIFFUSION AND TRANSMISION** CAPABILITIES BETWEEN CELLULAR TISSUES AND **THROUGH** CELLULAR MEMBRANES.

H2 IS A SAFE, INNOCUOUS / HARMLESS ANTIOXIDANT : WITHOUT ANY SIDE EFFECTS.
 THERE IS NOT ANY WASTE OF CHEMICAL PRODUCTS AFTER ITS REACTION (FR / OXIDANTS). ONLY WATER.

THE MOST OF THE ANTIOXIDANTS GET SOME CHEMICAL WASTE AFTER THEIR CHEMICAL REACTION. SO A MAXIMUM DOSIS PER DAY IS REQUIRED BECAUSE THE HUMAN BODY NEEDS TIME TO FLUSH THE WASTE OF THE CHEMICAL REACTION AWAY .

SO THERE IS NOT ANY MAXIMUM DOSIS LIMIT PER DAY OF HYDROGEN WATER BECAUSE THERE IS NOT ANY CHEMICAL WASTE TO BE FLUSHED AWAY. (H2O).

THE MAXIMUM AMOUNT OF WATER THAT CAN BE DRUNK PER DAY IS 7 LITERS. (IF MORE, THEN AN HIPONATREMIA IS GOT : LOW SODIUM (Na) CONCENTRATION IN BLOOD).

- STUDY MADE *IN VITRO* WITH HUMAN CELLS.
 - (ARP-19). NORMAL ONES. RETINA CELLS
 - (HELA). CERVIX CARCINOGENIC CELLS.
- STUDY OBSERVES THAT:

A CHRONIC TREATMENT (CELLS ARE FED WITH H2 WATER SO OFEN) :

• IT CAN CONFIRM THAT THERE IS A HIGH ANTIOXIDAN EFECT INSIDE THE NORMAL CELLS (MULTIPLIER EFFECT)

• IT CAN CONFIRM THAT THERE IS NOT ANY MULTIPLIER ANTIOXIDANT EFFECT INSIDE THE CARCINOGENIC CELLS.

- Suero salino intravenoso enriquecido de hidrógeno.
- A través de la inhalación de H₂ gas.
- Perfusión abdominal.
- Hidroterapia con burbujeo de hidrógeno.
- Aplicador de hidrógeno para la piel.
- Equipos para duchas.







Different ways to intake Hydrogen



http://www.molecularhydrogeninstitute.com/water-ionizers-and-hydrogen-water-generators

Many people have reported benefits from using alkaline water ionizers, but it wasn't until 2007-2010 that scientists and researchers understood that the therapeutic property in alkaline ionized water was hydrogen gas (see this article). Alkaline water ionizers were optimized and designed to produce alkaline water, not hydrogen gas. There are 3 observations with these systems:

- some alkaline water ionizers do not contain sufficient levels of dissolved hydrogen gas or at least their concentration is below a detection limit of 0.01 ppm.
- Some alkaline water ionizers can produce adequate hydrogen gas levels, but due to their production of alkaline water, the electrodes tend to scale up quickly, which prevents the hydrogen gas from dissolving into the water.
 Therefore, without cleaning the systems with citric acid or vinegar, the concentration of hydrogen gas can also drop below 0.01 ppm in a matter of days to weeks depending on source water and usage.
- Some alkaline water ionizers employ a reversing-polarity technology, which significantly prevents scale build up on the electrodes, allowing the user to go longer (months to years) without having to use vinegar or citric acid.

How to keep the Hydrogen in the water.



Cambio de concentración de hidrógeno del agua para el almacenamiento a largo plazo en condiciones especiales.

Cambio de concentración de hidrógeno del agua para el almacenamiento a largo plazo en botellas bajo presión atmosférica.

- Hydrogen water must be drunk just after dispensed. (1 2 hours in an open container)
- Water can keep a high concentration of H2 inside SS or glass bottle without any air gap. (in a fridges if pos
- Plastic bottles can't mantain H2 inside for too long. (h2 pass throught polymers easily).

INFUSIONS WITH HOT H2 WATER

- THE MORE TEMPERATURE THE MORE GASSES AND H2 LEAVES THE WATER.
- IF IT BOILED THEN IT WOULD MISS THE H2.





HYDROGEN WATER IS SAFE

It MEETS the RD 140/2003 regulation and UNE 149101 standard requirement.





FDA consideres that H2 is safe.

Europe regulation consideres H2 a safe food aditive E949, as propulsor gas and as packaging gas (RD142/2002)