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The Role of Deuterium-Depleted Water as a Health Supplement

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ABSTRACT

This paper is a review of the published literature concerning the potential health benefits of Deuterium-Depleted-Water (DDW), focusing specifically on the potential efficacy of DDW in the role of cancer prevention and treatment. A review of studies using DDW to treat numerous cancer types has been completed and is summarized. Articles and publications that describe the potential benefits of the use of DDW as a general health and dietary supplement are also summarized.

Keywords: Deuterium, Cancer, Tumor regression, ATP

I. INTRODUCTION

Deuterium, also called heavy hydrogen, is a non-radio-active isotope of hydrogen. Referred to in science literature as D, or ^{2}H, it is composed of one proton, one neutron, and one electron as opposed to Hydrogen with a proton only. Deuterium is found in water across the globe, with approximately 155 ppm in ocean water at the equator but considerably less at the poles, down to approximately 89 ppm. Since its discovery in the 1930's, deuterium has been the subject of much investigation. Studies now indicate deuterium depletion may have a profound effect upon general health and specifically an inhibitory effect upon cancer.

II. EARLY RESEARCH & FINDINGS

A. Animal Testing in Europe

In the 1990's, experiments at the Romanian University of Medicine and Pharmacology began to show that damaged DNA in mice could be effectively repaired by reducing deuterium in water to 30 ppm as a treatment to mice that were exposed to radiation. This work established the research of Gabor Somylai in Hungary who published the paper *The Biological Effects of Deuterium Depletion* and a subsequent book entitled *Defeating Cancer* (Somylai, 2001). These early developments in Hungary led to drug development for both cats and dogs. In subsequent studies, this initial drug showed an efficacy of 70-80% in halting or reversing tumors. The first drug based upon deuterium depletion (Vetera-DDWS-25) was registered for use against tumors in household pets in Hungary in 1998 and is available commercially today as a direct treatment of common tumors as well as prevention of the same.

B. Further Studies

In 2006, the published paper *Relationship between Natural Concentration of Heavy Water and Rate of Isotopologues and Rate of H2O2 Generation by Mitochondria* by Pomytkin and Kolesova showed that the damage caused by heavy water (D) was somehow related to the mechanism within the mitochondria. Later, this led to the discovery by Pomytkin that deuterium has a negative effect upon ATP production. In 2007, Olgun's paper *Biological Effects of Deuteronation: ATP Synthase as an Example* illustrated the mechanism of action resulting from excess deuterium upon the ATP Synthase engine, effectively causing the ATP "motor" to lose efficiency to the point of failure. At long last, the mechanism behind the apparent negative effects of excess deuterium were beginning to be unraveled. Technologists began the development of methods for mass production of deuterium-depleted water, aimed at small initial studies and pre-clinical trials. Conferences began to appear in Europe, highlighting deuterium depletion as a potential health benefit. Laszlo Boros co-founded the Center for Deuterium Depletion where protocols were established for cancer, metabolic disorders, immune dysfunction and infections. Meanwhile, the evidence for the potential nonproliferation effects of deuterium depletion against various types of cancer continued to build. Proponents of alternative and holistic medicine embraced deuterium depletion as a supplement to traditional treatments.

III. CURRENT EVIDENCE AND PUBLICATIONS

A. In 2019, the paper *Anticancer Effect of Deuterium Depleted Water - Redox Disbalance Leads to Oxidative Stress* by Zhang, et al included a comprehensive table summarizing DDW-based cancer studies performed with animals and humans. An edited version of this table is below, highlighting the studies where antiproliferation to cancer was observed. (Three studies which showed no evidence of antiproliferation to cancer were removed from the original table for the sake of brevity.) Numerous other applications have been studied , with a few indicated at the bottom of Tab. 1. Among the most significant results is the published paper *Deuterium Depletion Inhibits Cell Proliferation , RNA and Nucleear Membrane Turnover to Enhance Survival in Pancreatic Cancer*, (Boros, et al, 2021) This paper describes how the Median Survival Time for pancreatic cancer patients was significantly increased with DDW treatment in comparsion to conventional chemotherapy alone.

B. Studies related to the effects of DDW on depression susceptibility (Sytrekalova et al, 2015) and long-term memory (Mladin et al, 2014) have shown promise in both mice and rats, respectively. These studies are of particular interest to researchers investigating predictors of mental health disorders.

TABLE 1, a summary of cancer-related studies, follows:

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TABLE 1 – CANCER ANTIPROLIFERATION STUDIES

Organism		Cancer type	DDW(ppm)	DDW effect	Ref.
Mice		Normal fibroblasts	30–600	20% decrease in cell count at 30 ppm; 35% increase in cell count at 600 ppm	(A)
Human		Breast	30	83% increase in survival of xenotransplanted mice	
Human		Prostate	90	15% decrease in cell count	(B)
		Breast		10% decrease in cell count	
		Melanoma		16% decrease in cell count	
		Prostate	90–95	5% decrease in tumor volume	
			98	2 times higher in apoptosis of cells xenotransplanted in mice	
Mice		Hematopoietic stem	90	42% & 20% decrease in cell count	
Dog		Breast	90–95	67% decrease in tumor volume	
Mice		Liver	52	67% increase in H2O2 generation at mitochondria	(C)
Human		Lung	25–105a	Noticeable increase in survival time of all 4 lung cancer patients	(D)
Human		Lung	25–150	31% decrease in cell count at 105 ppm	(E)
		Lung		30% decrease in tumor growth of H460 xenograft model mice at 50 ppm	
Human		Prostate	85a	50% decrease in prostate specific antigen (PSA); 59% decrease in tumor volume; 33% increase in patient survival	(F)
Human		Lung	25–105a	11% increase in patient survival	(G)
Mice		Lung	25	Significant ($p < 0.05$) increase in expression of Kras, Bcl2, Myc	
Human		Breast	65–105a	2–3 times longer median survival time (MST) compared to only conventional therapy; 3 times longer MST of patients who took DDW more than once than those who took it only once	(H)
Human		Nasopharyngeal	50–150	40% decrease in cell count at 50 ppm	(I)
		Normal preosteoblast		73% increase in cell count at 75 ppm	
Mice		Liver	46	35% increase in generation of hydrogen peroxide at mitochondria	(J)
Rats		Liver	46	18% decrease in weight of rats; 15% increase in aspartate aminotransferase; 43% increase in (AST) alanine amino-transferase (ALT); 35% increase in generation of hydrogen peroxide at mitochondria	(K)
				OTHER PUBLISHED RESULTS	
Human		Pancreatic cancer	25,50,105,150	Increased median survival time to 19.6 months vs 6.36 months on chemotherapy alone	(L)
Rats		Inflammation	16, 30	Prevention of hepatoxicity and healing effects upon liver	(M)
Worms		Anti-aging	90	Restored life span from toxicity exposure to manganese	(N)

IV. Conclusion

The study of DDW and its potential health benefits originated in the holistic and alternative medicine arenas. As a result, DDW has been slow to be accepted as a primary source of treatment for disease states nor as a supplement to traditional treatments. However, over the last 25 years, sufficient studies have been performed and numerous peer-reviewed papers have been published to merit a more serious look from a pharmacological viewpoint. Based upon the abundance of scientific evidence now available to tie metabolic dysfunction to the adverse effects of excess deuterium in water, it is concluded that full clinical trials should be performed to satisfy the requirement for an unbiased clinical analysis.

V. Future Research & Commercialization Considerations

It is worth noting that large pharma companies have seemingly been reluctant to commit to the financial burden of full clinical trials when there is no readily apparent Intellectual Property nor subsequent drug candidate that can easily be obtained after clinical trials of plain deuterium-depleted bottled water. Ironically, the commercial availability of bottled DDW on the market essentially acts as a roadblock to profit-motivated pharma companies. Stockholders of pharma companies would understandably be wary of making an investment of tens of millions in clinical trials of DDW, without the prospect of a marketable drug candidate. Perhaps as an alternative, a consortium of biotechnology entrepreneurs, beverage providers and clinicians could be assembled to structure a comprehensive clinical trial for DDW against cancer and other maladies. In any case, the scientific premise that DDW provides general health benefits and specifically acts as an antiproliferation agent against many forms of cancer, is now well documented.

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