

Effects of the Intake of Deuterium Depleted Water During Cancer Therapy: A Narrative Review

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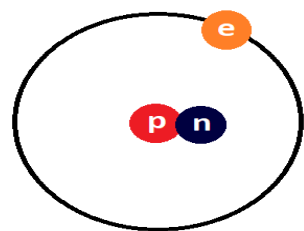
Abstract

Drinking water has a deuterium (^2H) concentration of 150 ppm. The intake of deuterium-depleted water (DDW) provides a series of effects on the improvement of the state of health, contributing to the prevention of various diseases, as well as the delay in the evolution of certain types of cancer. The objective of this review is to verify the influence of DDW intake on the regression and survival rate of different types of cancer in living beings. The intake of DDW in patients with chronic lymphocytic leukemia, lung, prostate and breast cancer, as well as the antitumor effects of the intake of DDW in living beings, were analyzed. In conclusion, commenting that the intake of DDW has beneficial effects on the increase in the average survival time of cancer patients, favors the inhibition of cancer cell growth, increases the probability of total or partial regression of malignant tumors, as well as the delay in the multiplication of various types of tumor cells (PC-3, MDA, HT-29 and M14) and contributes to the decrease in PSA values in patients with prostate cancer.

Keywords: deuterium depleted water, cancer, chemotherapy, antitumoral.

Introduction

Water is the major component on earth and is essential for human life. Water has an inhomogeneous isotopic composition, with the heavier (heavy water) or semi-heavy (semi-heavy water) molecules being those that accumulate in the lower part of the atmosphere, while the lighter molecules (light water) are those that evaporate earlier. On land, deuterium (^2H) levels in water (Figure 1) range from 14 to 150 ppm [1].



e = electron
p = proton
n = neutron

^2_1H

Figure 1. Deuterium.

The ratio of ^2H to protium (^1H) in both still and bottled water can vary significantly between continents and climatic zones. Isotopic composition variations in natural water sources are explained by shifting the isotopic equilibrium in a variety of cases as a result of phase transitions in the water cycle [1].

The human body is made up of 60-65% water. The ^2H content in body water is 0.015%. At a quantitative level and from highest to lowest, ^2H ranks 12th among the elements that make up the human body, ahead of copper, iron, zinc, molybdenum or manganese in the body, whose content in the body is 10 to 100 times less than ^2H . So the excess or deprivation of deuterium can alter the biological activity of the organism [2].

The isotopes of certain biogenic elements of a non-radioactive nature (Figure 2) such as hydrogen (^1H and ^2H), oxygen (^{16}O , ^{17}O , ^{18}O), carbon (^{12}C , ^{13}C) and nitrogen (^{14}N , ^{15}N); they cause a series of effects on the biochemical reactions and physiological processes of the organism, with a prominent influence on growth and development in both unicellular and multicellular organisms, as well as influencing energy metabolism and metabolic rate [3].

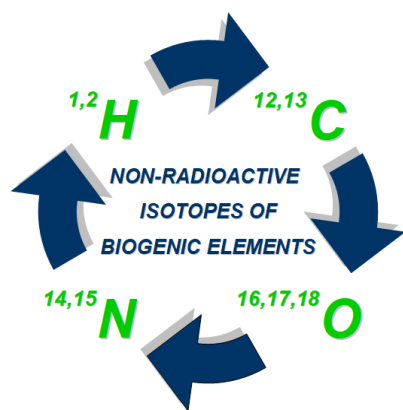


Figure 2. Non-radioactive isotopes of biogenic elements.

Deuterium depleted water or deuterium depleted water (DDW), known as light water, has a ^2H concentration of 20-25 ppm naturally compared to 150 ppm in drinking water. The use of DDW for a

prolonged period can reduce the concentration of ^2H in the fluids and tissues of organisms due to isotopic exchange reactions. These reactions can affect the cell cycle and cell proliferation [4].

Numerous investigations have established that DDW can be used as an adjuvant in the prevention and/or treatment of cancer with the aim of reducing cytostatic toxicity, protecting the immune system from pharmacological treatments applied in cancer therapy, in addition to its anti-inflammatory effects decrease in tumor mass and/or its total regression [5].

DDW constitutes a new alternative as an anticancer agent applicable in cancer therapy, and it also has high potential in different clinical applications [5].

Material and Methods

A descriptive review study has been carried out with the objective of answering the following research question: What effects does the intake of DDW have on the egression and survival rate of different types of cancer?

For this, a search was carried out in databases such as Pubmed and Google Scholar in August 2023. In order to find the largest number of articles possible, the following keywords were used: deuterium depleted water, cancer, prostate, lung, and breast.

For the selection of articles, inclusion criteria were used such as: articles published in any country, articles published in English, articles where DDW is ingested in living beings with cancer and articles where the research is carried out in vivo and in vitro; The exclusion criteria were established: articles that do not clearly show the intake of DDW, articles that do not refer to cancer therapy.

Results

DDW Intake and Chronic Lymphocytic Leukemia

In a case study conducted by Kovacs

et al. [6], in a patient with chronic lymphocytic leukemia. Once the disease was diagnosed, the patient started DDW, resulting in significant improvement in all major parameters, including blood counts and lymph node regression. After a break in DDW consumption, disease progression occurred and cervical lymph node size increased. However, after restarting the DDW ingest the parameters resubmitted. The authors suggest that taking DDW may postpone the need for conventional chemotherapy for several years [6].

DDW and prostate cancer

In a 4-month randomized double-blind clinical trial conducted by Kovacs et al. [7], 91 prostate cancer (PC) patients treated with DDW were evaluated and the median survival time (MST) was calculated in the subgroups. The 91 patients evaluated achieved an MST of 11.02 years, despite the fact that 46 of them had metastases. The authors demonstrated that the administration of DDW should be implemented in the treatment of CP as an adjunctive therapy [7].

In a study conducted by Kovacs et al. [9], showed how a patient with prostate cancer began to consume DDW one month after the cancer diagnosis. After one month of DDW consumption, her PSA level dropped from 8.7 ng/mL to 6.3 ng/mL and 1.5 years later an magnetic resonance imaging (MRI) could not confirm the presence of the 1 cm diameter tumor. During 11 years of prostate antigen (PSA) follow-up, deuterium depletion was shown to control the growth of prostate cancer. The investigation showed that increasing the duration of the DDW consumption break from 5-6 months to 11 months caused the disease to progress, using MRI. The patient underwent 13 periods of DDW treatment for 11 years with breaks between 5-6 months and 11 months, the investigation showing that the longer the break between periods of DDW consumption, the more the disease progressed. The study confirmed that DDW treatment is effective in

the early stage of the disease as sole therapy, delaying the application of conventional therapy [9].

Antitumor effects of DDW

In a study conducted by Somlyai et al. [8], showed the antitumor effect in living organisms that DDW had at 30±5 ppm on various types of tumor cells: PC-3 (prostate), MDA (breast), HT-29 (colon) and M14 (melanoma) ; stopping their multiplication. DDW caused tumor regression in xenografted mice and induced apoptosis both in vitro and in vivo. DDW at 25±5 ppm induced full or partial tumor regression in dogs and cats with spontaneous malignancies [8].

DDW intake and lung cancer

In a study conducted by Krempels et al. [10], the impact of DDW consumption in patients with lung cancer and brain metastases was investigated. The patients were diagnosed with brain metastases derived from a primary lung tumor and began taking DDW immediately after the diagnosis of the brain metastasis. For this, the daily water intake of these patients was 100% with DDW combining the conventional forms of treatment. Patients markedly prolonged MST [10].

In a study conducted by Somlyai et al. [12], showed how the reduction of body deuterium through the intake of DDW increased the MST in lung cancer from 3 to 7 times.

DDW and breast cancer

In a study conducted by Yavari et al. [11], which aimed to expose how treatment with DDW at 30-100 ppm and 5-fluorouracil (5-FU) showed inhibitory effects on the growth of MCF-7 breast cancer cells [11].

In a study conducted by Somlyai et al. [12], showed that DDW intake doubled MST in advanced breast cancer and was effective in preventing relapse of early-stage breast cancer [12]

In a study conducted by Movahedi et al. [13], whose objective was to investigate the effect of DDW intake in combination with 5-FU on cell growth and the antioxidant system of breast cancer cells, showed how DDW intake at 100-125 ppm ^2H produced a growth-inhibitory effect on MCF-7 cells compared to the control group that had 150 ppm ^2H water intake. In addition, it was observed that the intake of DDW in lower concentrations of ^2H increased the activity of the enzyme catalase and superoxide dismutase, decreasing the level of malonyldialdehyde [13].

Conclusions and Future Directions

As conclusions of this review, it is highlighted that the intake of DDW has beneficial effects such as: the increase in the average survival time of cancer patients, the inhibition of the growth of cancer cells, the total or partial regression of malignant tumors, delay in the multiplication of various types of tumor cells (PC-3, MDA, HT-29 and M14) and decrease in PSA values in patients with prostate cancer. The number of studies carried out with DDW are very scarce in the scientific literature, so more studies are needed on the influence of DDW intake during the treatment and prevention of cancer.

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