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Epidemiology of Inflammatory Bowel Diseases and Quality of Drinking Water assessed by Dissolved Oxygen Levels

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ABSTRACT

The incidence of inflammatory bowel diseases [IBD] has risen over the past decade to become a global issue. Annual incidence rates varied by geographical region with IBD estimates ranging from 10.5 to 46.14 per 100 000 in Europe, 1.37 to 1.5 per 100 000 in Asia and the Middle East, 23.67 to 39.8 per 100 000 in Oceania, 0.21 to 3.67 per 100 000 in South America, and 7.3 to 30.2 per 100 000 in North America. Although it has been studied a lot, it is not understood why it is spreading or how it does it.

Key environmental factors implicated in IBD pathogenesis include exposure to tobacco smoking, antibiotics, non-steroidal anti-inflammatory drugs, oral contraceptives, infections, agrochemicals, persistent chemicals as PFAS, and ultra-high processed foods. It seems that the etiology of IBD is multifactorial, like many diseases. The probable etiologies have been explored from various points of view, but there have been no results that allow significant progress in both prevention and better therapeutic management of patients.

In this paper we describe the consistent inverse correlation between IBD and low levels of dissolved oxygen in the drinking water supplied to the population, and that has consistently gone unnoticed in the numerous works published on the subject.

The importance of dissolved oxygen levels in drinking water is greater than we thought, in addition to the possibility that the management of a single parameter (dissolved oxygen levels) has an important impact on both the prevention and therapeutic management of patients, allowing a better prognosis and better quality of life.

Keywords: Dissolved oxygen, dissociation of water, electromagnetic radiation, energy, hydrogen, oxygen.

Introduction

The study design would be within the analytical observational class.

The global burden of inflammatory bowel diseases (IBD) is increasingly influenced by the conditions and effects of globalization, including the worldwide dissemination of both infectious and non-infectious public health risks.[1] The impacts on daily life associated with globalization have induced discernible and tangible health consequences in practically all countries around the world.

Today's increasing health risks globally are closely related to urbanization and altered lifestyles, especially air pollution, unhealthy diets, physical inactivity, smoking, and excessive alcohol use. The changes in working and living habits and their consequences for physical, mental, and social health contribute to the global harmonization of diseases. In many developing and emerging countries, this is associated with a double burden of disease due to the simultaneous occurrence of infectious and non-communicable diseases.[2]

The incidence of IBD was increasing or stable in virtually every region of the world that had been studied.[3] The incidence and prevalence of IBD were highest in westernized nations. By 2020, the newly industrialized countries/regions of Asia and Latin America had seen a rapid rise in incidence.[4] The emergence of IBD in these traditionally low-prevalence regions suggested that the development of IBD might be influenced by environmental risk factors. Association studies have shown several environmental risk factors for IBD, including cigarette smoking, antibiotic use, breastfeeding, and appendectomy.[5] Several environmental factors [smoking prevention, breastfeeding, a diet high in fiber, judicious use of antibiotics] can be targeted to reduce the incidence of IBD, but different populations [e.g. children, older patients] with different risk factors might require interventions at different time points, which complicates things. But one thing in common with the factors mentioned above is the decrease in dissolved oxygen levels in drinking water that accompanies these pollutants and that always goes unnoticed.

Furthermore, exploding numbers of synthesized compounds have led to new challenges in environment assessment during the last few decades. In addition to soil and air monitoring, the analysis of water quality has become a fundamental task. Toxicity tests are mainly based on the survival of organisms in the presence of test material. Static tests permanently expose the organisms to a series of dilutions over 24 or 48 hours. Dynamic tests, on the other hand, shorten the test procedure and allow continuous monitoring. However, the sensitivity and specificity of these studies is limited, given the large number of toxic substances and other factors involved.

The mere identification of toxic compounds in water is a formidable challenge, which together with the presence of common organic compounds in wastewater, such as human and animal feces, herbicides, pesticides, fertilizers, industrial waste, PFAS, etc., cause the outlook to become bleak. But there is one characteristic of water in particular that is very important: the levels of dissolved oxygen. Apparently, although it has been dimensioned for decades, it was not given the due importance due to at least two factors, 1) almost anything that falls into the water decreases the levels of oxygen dissolved in it, and it was believed that by purifying the contaminated water, oxygen levels would rise "spontaneously", which has not happened anywhere in the world, and 2) the unsuspected ability of human cells to dissociate the water molecules that these cells contain inside them was not known.

Therefore, if we analyze the possible correlation between the levels of dissolved oxygen in the drinking water supplied to the population and the incidence and prevalence of inflammatory bowel disease (IBD), we find that the lower the levels of dissolved oxygen in drinking water, the incidence and prevalence of IBD is significantly higher and vice versa.

For instance, Crohn's disease [CD] estimates ranged from 4.1 to 22.78 per 100 000 in Europe, 0.09 to 3.6 per 100 000 in Asia and the Middle East, 13.23 to 26.0 per 100 000 in Oceania, and 0.04 to 0.64 per 100 000 in South America, and ulcerative colitis [UC] estimates ranging from 3.0 to 23.36 per 100 000 in Europe, 0.69 to 5.0 per 100 000 in Asia and the Middle East, 7.33 to 17.25 per 100 000 in Oceania, and 0.16 to 2.99 per 100 000 in South America.

Comparison of population-based data reveals that the incidence of IBD has risen rapidly in the East while plateauing in the West.[6] However, the compounding prevalence of IBD in the West is increasing and is driven by the incidence of IBD exceeding mortality rates. The clinical presentation and disease course of IBD differ between East and West with more patients in the East presenting with complicated disease. However, epidemiological studies in this regard usually do not consider the possible inverse correlation between dissolved oxygen levels (DOL) and the incidence and prevalence of inflammatory bowel diseases (IBD).

Geographical epidemiological variability has been described both intercontinentally and within certain individual countries.[7] In Europe, for example, although the rapidly rising incidence rates in the east are now like those in the west, other persistent differences include a less complicated disease at diagnosis, decreased need for surgery in CD, and lower rates of colorectal cancer in UC compared to the west.[8] Within individual countries, such as the USA, France, Portugal, Spain, and Italy, there is a north– south disease gradient for incidence, whereas Canada demonstrates an east–west disease gradient; these differences are probably due to differing environmental exposures. But when you consider that water in cold climates tends to have higher levels of dissolved oxygen compared to warmer water in warm climates, then the north-south gradient starts to make sense.

Take the example of the island of Tenerife, in Spain.

The island of Tenerife is one of the main Canary Islands and a growing tourist destination. It was visited by 4 730 425 tourists in the year 2000. The island has a territorial extension of 2,034.38 square kilometers and a maximum height of 3,718 meters; it currently has a population of 928,604 inhabitants. The average annual rainfall is 394 mm.

Tenerife and the Canary Islands in general are regions with a shortage of water resources, so throughout history it has established a management system to obtain water from desalination processes, as well as implementing the use of wastewater regeneration in agriculture in the area. In the Canary Islands, there are three fundamental types of water resources: surface water, groundwater and industrial production water (desalination plants and treatment plants), which in 2018 reached a total of 136,016.00 cubic meters. In the last decade, the generation of water resources using desalination has increased reaching 121,346.00 cubic meters, since natural water resources have been decreasing, since in some islands the extraction of aquifers has exceeded their recharge.

Due to the overexploitation of aquifers over the years, they have led to poor water quality, in which values of nitrates, chlorides, sulphates and conductivity that exceed the established thresholds are detected[9], which invariably leads to lower and lower dissolved oxygen values.

The number of wells in Tenerife is 393, with a flow of 64 hm^3 per year, as well as 1051 galleries, which represent an annual flow of 120 hm^3. Tenerife has 34 desalination plants, which represents a flow of at least 102,084 hm^3 per year. Tenerife has 34 wastewater treatment plants, which allows it to treat approximately 52% of this water, and the rest is thrown into the environment (the ocean). The so-called natural purification systems are used, which are characterized by using little energy and apparently trying to comply with the standards of the European Union[10], but the efficiency of such systems is almost average, and it seems that they almost meet the standards regarding intestinal nematodes and eggs, Escherichia coli (CFU), suspended solids in mg/L, and degree of turbidity in NTU, but they do not pay the slightest attention to the levels of dissolved oxygen(DOL) in both drinking water and treated water.

And it is common behavior by the bodies responsible for water management, to omit this specific data (DOL), overall, when it is significantly low. For instance, in the WHO global health data, in 2023; Spain reported 100 % of proportion of population using safely managed drinking-water services, in the field proportion of population using safely management sanitation services 90 %. About the proportion of safely treated domestic wastewater flow, the cite proportion is 80 %.[11], which contradicts the data cited above, about the fact that in Tenerife only about 52% of the wastewater is treated, and the rest is thrown into the ocean that surrounds the island, (which explains the very frequent brown circle in the seawater that surrounds the island as well as the daily life foul smell on the beaches), which together with the intensive desalination of seawater, allows us to foresee what has already been observed in other countries with similar water management, referring to a greater decrease in the levels of dissolved oxygen in the surrounding seawater and that sooner or later It also affects surface waters and groundwater.

The incidence and prevalence of Crohn's disease in Spain reaches 17 per 100,000 inhabitants < 14 years old.[12]

Incidence of Crohn's disease worldwide

The example of the island of Tenerife, in Spain, gives us an idea of the complexity of the comparison of statistical data, since the different countries and regions show significant differences between them, from the definition of clinical criteria to the collection of samples and data, including in relation to the physicochemical characteristics of drinking water. not to mention the interpretation.

Therefore, to simplify the comparison between the incidence and global prevalence of Crohn's disease (Figure 1) and its inverse relationship with the levels of dissolved oxygen in the drinking water supplied to the different populations, we present Figure 1 and Figure 2.

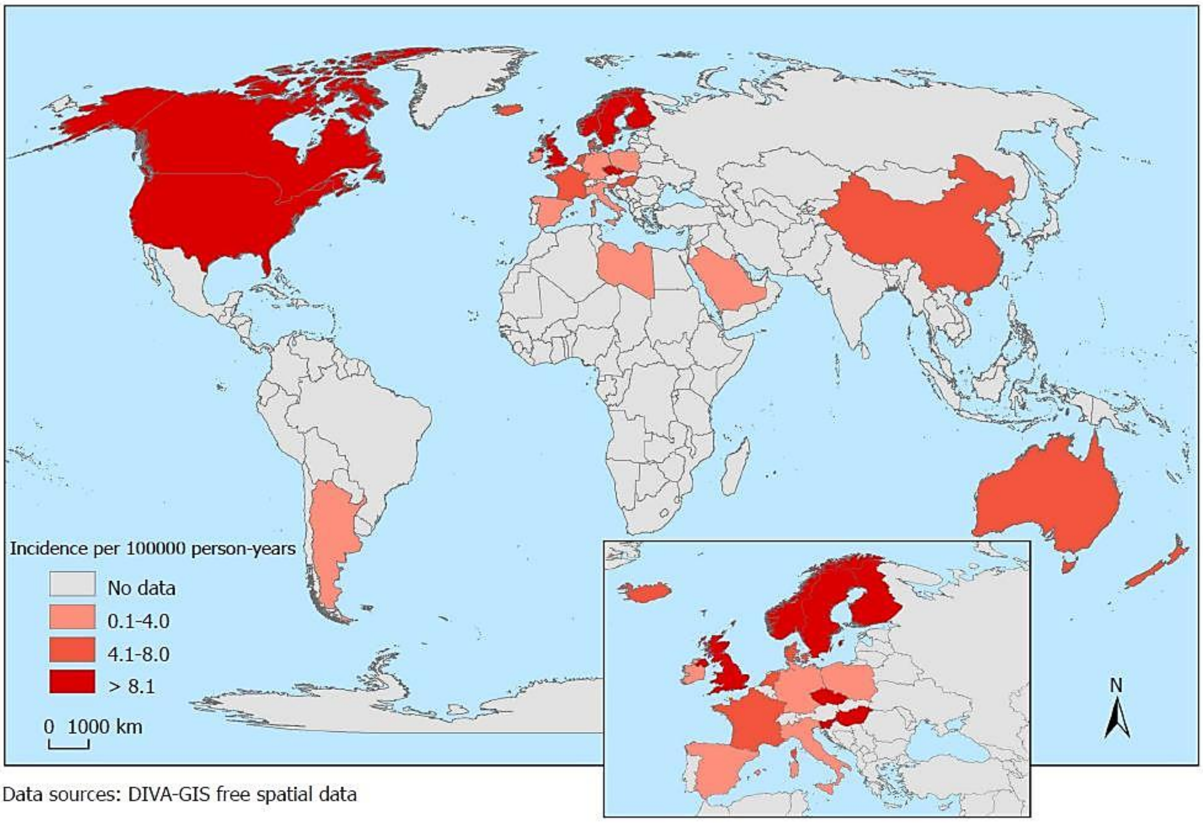

Figure 1) Worldwide pediatric inflammatory bowel disease incidence rates. Inflammatory bowel disease (IBD) choropleth map of global incidence of pediatric IBD divided into four colors representing unknown, low, indeterminate and high occurrence of disease. Grey reflects absence of data.[13]

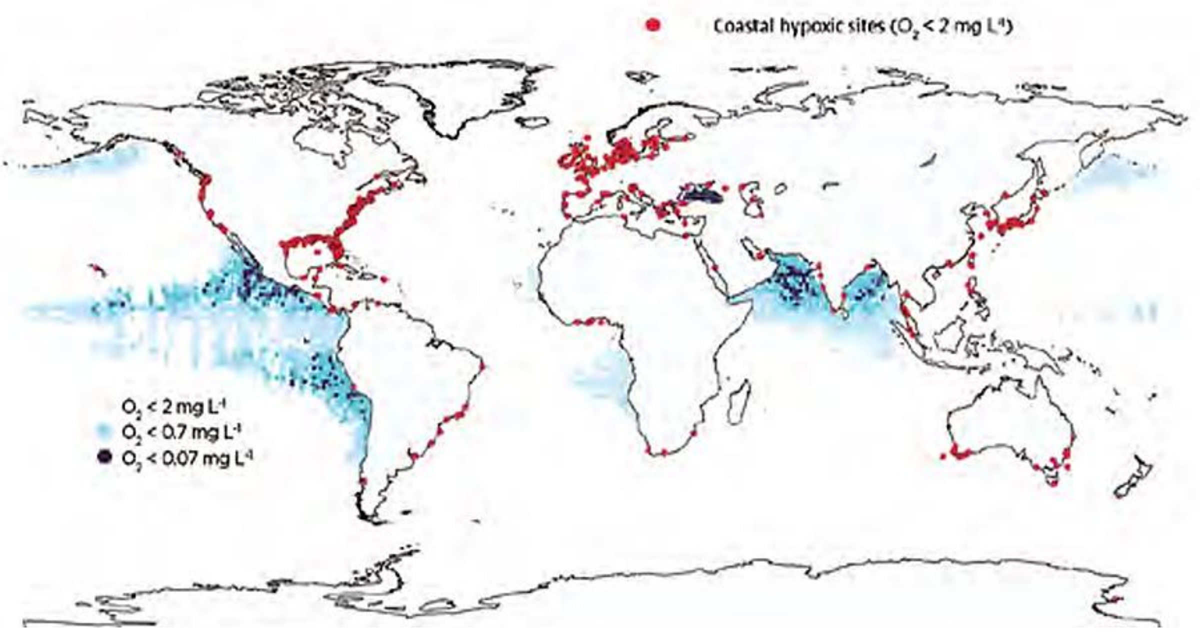

Figure 2) During the past 50 years, the area of low oxygen water in the open ocean has increased by 4.5 km^2 (red dots).[14] The blue dots indicate the significant presence of nitrogenous compounds due to the indiscriminate use of fertilizers in intensive agriculture. The presence of nitrogen in water worsens dissolved oxygen levels, since nitrogen tends to displace oxygen into an aqueous medium.

The finding that human cells have molecules inside them, capable of transforming the power of light into chemical energy by dissociating water, as in plants[15]; represents a watershed in the study of Crohn's disease as it allows us to advance in the understanding of this pathology by being able to identify new data such as the inverse correlation between the levels of dissolved oxygen in the drinking water supplied to the population, as well as in the bodies of water near the environment. (Figure 3)

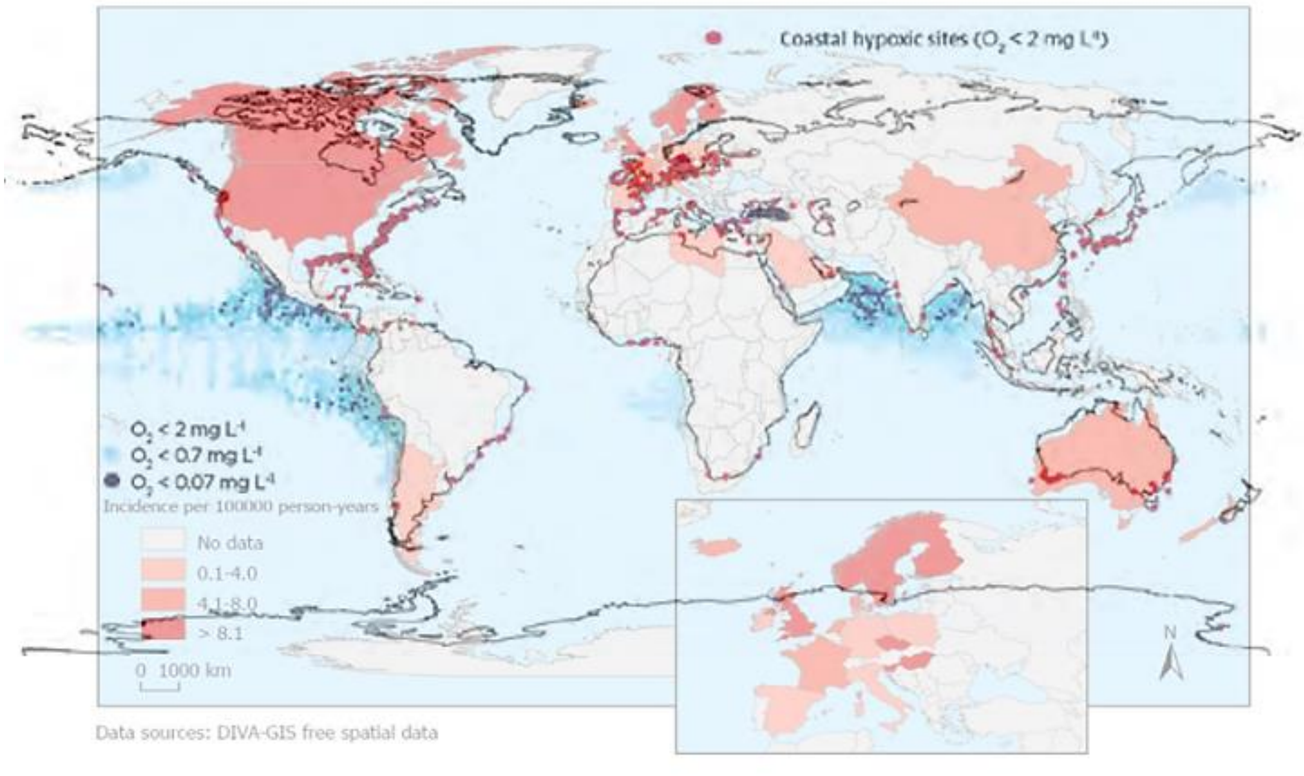

Figure 3) The superposition of both figures coincides remarkably.

Importance of Dissolved Oxygen Levels in Cell Biology

The dissociation of water molecules at the intracellular level occurs mainly in the perinuclear space, through an amazingly accurate chemical reaction, which can be expressed as follows:

$$2H_2O_{(liq)} \rightarrow 2H_{2\,(gas)} + O_{2\,(gas)} \rightarrow 2H_2O_{(liq)} + 4e$$

The part of the water dissociation process highlighted in green occurs strictly inside the melanin molecules, the part of the reaction highlighted in blue occurs both inside and outside the melanin molecule.

The hitherto unknown ability of human eukaryotic cells to dissociate the molecules of the water they contain inside opens a new panorama in the area in the field of cell functioning, as it explains the attraction of water from the immediate surroundings (and from the cell nucleus) to the interior of the cell without wasting energy, which implies rethinking the distribution of energy that the cell uses daily, since it was thought (mistakenly) that the transport of water, a non-compressible liquid; it required almost two-thirds of that energy to transport across the cell membrane. (Figure 4). But now we know that the energy required to dissociate the molecule from water, the cell obtains from sunlight.

Figure 4) In the usual schemes in which both the cell and its organelles are described, for various reasons, melanosomes whose main location is the perinuclear space are never represented.

To date, the explanation of the dynamics of water (input/output) inside cells is based on relatively basic mechanisms (simple diffusion, facilitated diffusion, osmosis, tonicity -hyper/hypo-, etc.)[16], which in the end fail to explain in a congruent and coherent way the very precise and constant characteristics of cellular hydration.

But adding to the diagram one of the main molecules (melanin/melanosomes) of intracellular location that have the intrinsic property of transforming the power of light into a type of chemical energy that can be used by living beings, through the dissociation of intracellular water, as in plants (figure 5), then the movement of water inside the cell (input/output) has a plausible explanation, because the dissociation of water creates a negative pressure suddenly dissipates the positive pressure existing inside the cell, resulting from the push of water, and since it is a non-compressible liquid, and when this positive pressure vanishes somewhat suddenly, we have a zone of negative pressure resulting from the process of formation of hydrogen and oxygen molecules from liquid water and that is happens strictly in perinuclear space so that water molecules are attracted from the immediate environment. This is from the cellular interstitium and from the very interior of the cells, including the nucleus.

It is relevant to consider that the process of water dissociation is constant, as well as incessant. And the speed of the process is in the range of nano and picoseconds for each water molecule.

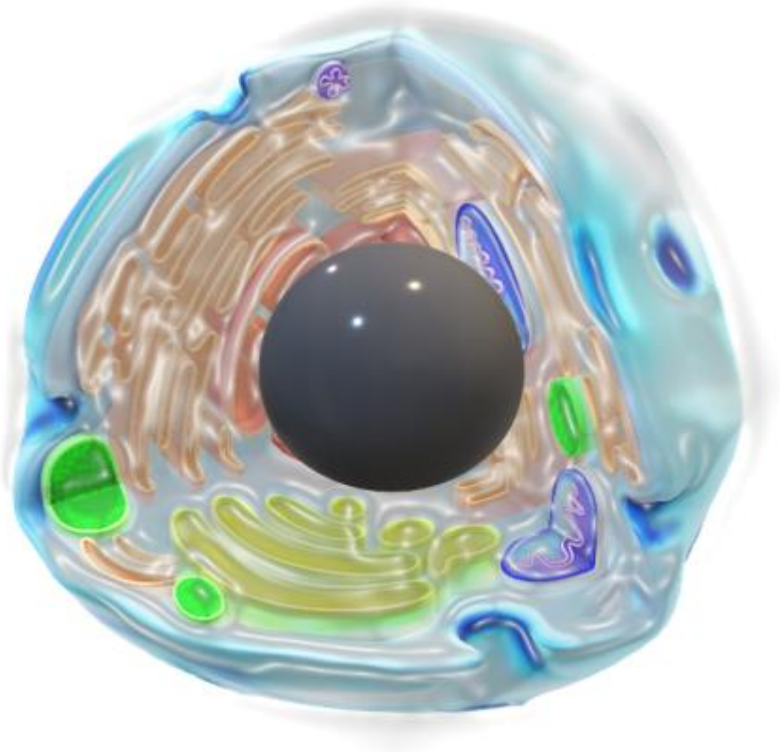

Figure 5) The representation of melanosomes in the perinuclear space, as well as understanding the fundamental function of melanin in transforming light into chemical energy, will mark a before and after in the biological sciences.

Correcting the collective error of not representing the most important intracellular component (melanin/ melanosomes) since the dissociation of water meets the requirements to be considered the fundamental reaction of life, since it explains the beginning of all other mechanisms, is basic to break the dogma about the mistaken belief that our body takes oxygen from the atmosphere that surrounds it and lead it to the cell taking oxygen (and hydrogen) of the water it contains by dissociating the molecule from water, as in plants.

The dissociation of water molecules into melanin is an amazingly accurate reaction that has not changed since the beginning of time, as it is one of the fundamental pieces of the origin and evolution of life.

And if it happens with a turnover rate adequate to the metabolic needs and requirements of the cells, then tissues, organs, and systems are going to work well because the body is very well made.

But in today's life, this fundamental reaction is thrown out of balance by the contamination of water, air, and food. And if the main process of life is wrong, then the body is worse. All or almost all diseases begin when the oxygen balance at the intracellular level is affected, especially by the aforementioned factors. And each patient becomes unbalanced in their own way.

The functions of water in biology and medicine are more important than we thought, and even more so now that we know that our cells have the unsuspected ability to oxygenate themselves.

So, all the water with which we are in contact must have the appropriate physical and chemical characteristics so that our body can use it optimally. In a somewhat reductionist way, we should take care that the levels of dissolved oxygen in the water supplied by the various agencies in charge of its management had minimum levels of 6.5 grams per liter.

These levels tell us that our body can handle it properly, regardless of the organic molecules, xenobiotics, nitrates, phosphates, etc., that the water may contain. Any toxic molecule is less toxic in the presence of elevated levels (>6.5 g/L) of dissolved oxygen.

Let us bear in mind that current methods of purification of drinking water as well as wastewater treatment do not manage to raise the levels of dissolved oxygen, at most they reduce the incidence of epidemiologically important infectious-contagious diseases, but the chlorination of water leads to the formation of toxic compounds such as trihalomethanes.

It used to be thought that when water pollution rates decreased, dissolved oxygen levels would rise spontaneously, but this has not happened anywhere in the world, with any method and with any type of filter. Therefore, in addition to water treatments, the elevation of dissolved oxygen levels requires that this element (O_2) be introduced into the body of water to be treated, which is a formidable challenge that we must face as soon as possible[17], for the sake of patients and ourselves.

Conclusion

Until now, importance was given to the levels of dissolved oxygen in the water in the case of marine life, as it was thought that only they took oxygen from the water, although not like in plants. In the end, marine organisms also can oxygenate themselves (Figure 6), and the passage of water through the gills is to get rid of the CO_2 that is also constantly produced inside their cells, as in us. We dissolve CO_2 in the air; marine organisms dissolve it in the water that passes through their gills.

The purpose of this work is to draw attention to a parameter that usually goes unnoticed: the levels of dissolved oxygen (DOL) in drinking water. Since it is a variable that can be managed and therefore improved, which would result in a better level of health for both humans and marine organisms.

Figure 6) The function of melanin is the same in all living beings, that is: to transform the power of light into chemical energy, by dissociating the water molecule, as in plants. Photographs By Derek Nielsen[18]

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Conflict of interest:

None

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