EC Pulmonology and Respiratory Medicine Special Issue - 2017

How Bohr Effect Admits the Ozone Therapy Plus Specific Keto-Diet in the Treatment of Cancer

Mini Review

Dr. Somayeh Zaminpira* and Dr. Sorush Niknamian

Ph.D. in Cellular and Molecular Biology, University of Cambridge, United Kingdom

***Corresponding Author:** Dr. Somayeh Zaminpira, Ph.D. in Cellular and Molecular Biology, University of Cambridge, United Kingdom.

Received: November 07, 2017; **Published:** November 09, 2017

Abstract

This mini review article explains the impact of the specific keto-diet plus ozone therapy through the Bohr Effect in the treatment of all cancers including lung cancer. The Bohr Effect explains how the PH of the blood is important in absorbing the oxygen from the lungs which is an important factor in enrichment of the blood cells with oxygen. All cancer tumors cause the decrease in PH in tissues since cancer cells produce lactic acid. Increasing the blood PH through Vial Ozone Therapy causes the blood PH to increase which results in absorbing more oxygen from lungs and transport it to the acidic tissues. The keto-diet results in the increase in the blood PH as well.

Keywords: *Bohr Effect; Ozone Therapy; Keto-Diet; Cancer*

Introduction

Bohr Effect

The Bohr Effect is a physiological phenomenon first described in 1904 by the Danish physiologist Christian Bohr, stating that hemoglobin's oxygen binding affinity is inversely related both to acidity and to the concentration of carbon dioxide [1]. Since carbon dioxide reacts with water to form carbonic acid, an increase in CO_2 results in a decrease in blood pH [2], resulting in hemoglobin proteins releasing their load of oxygen. Conversely, a decrease in carbon dioxide provokes an increase in pH, which results in hemoglobin picking up more oxygen [3].

The Bohr effect increases the efficiency of oxygen transportation through the blood [5]. After hemoglobin binds to oxygen in the lungs due to the high oxygen concentrations, the Bohr effect facilitates its release in the tissues, particularly those tissues in most need of oxygen. When a tissue's metabolic rate increases, so does its carbon dioxide waste production [6].

When released into the bloodstream, carbon dioxide forms bicarbonate and protons through the following reaction: Although this reaction usually proceeds very slowly, the enzyme carbonic anhydrase which is present in red blood cells, drastically speeds up the conversion to bicarbonate and protons [4]. This causes the pH of the blood to decrease, which promotes the dissociation of oxygen from hemoglobin, and allows the surrounding tissues to obtain enough oxygen to meet their demands. In areas where oxygen concentration is high, such as the lungs, binding of oxygen causes hemoglobin to release protons, which recombine with bicarbonate to eliminate carbon dioxide during exhalation [7]. These opposing protonation and deprotonation reactions occur at an equal rate, resulting in little overall change in blood PH [8].

The Bohr effect enables the body to adapt to changing conditions and makes it possible to supply extra oxygen to tissues that need it the most. For example, when muscles are undergoing strenuous activity, they require large amounts of oxygen to conduct cellular respiration, which generates CO_2 and therefore HCO_3^- and H^+ as byproducts [9]. These waste products lower the pH of the blood, which increases oxygen delivery to the active muscles. Carbon dioxide is not the only molecule that can trigger the Bohr effect. If muscle cells aren't receiving enough oxygen for cellular respiration, they resort to lactic acid fermentation, which releases lactic acid as a byproduct. This increases the acidity of the blood far more than CO_2 alone, which reflects the cells' even greater need for oxygen. In fact, under anaerobic conditions, muscles generate lactic acid so quickly that pH of the blood passing through the muscles will drop to around 7.2, which causes hemoglobin to begin releasing roughly 10% more oxygen [11].

The Bohr effect hinges around allosteric interactions between the hemes of the hemoglobin tetramer, a mechanism first proposed by Max Perutz in 1970 [10]. Hemoglobin exists in two conformations: a high-affinity R state and a low-affinity T state. When oxygen concentration levels are high, as in the lungs, the R state is favored, enabling the maximum amount of oxygen to be bound to the hemes. In the capillaries, where oxygen concentration levels are lower, the T state is favored, in order to facilitate the delivery of oxygen to the tissues. The Bohr effect is dependent on this allosteric, as increases in CO_2 and H^+ help stabilize the T state and ensure greater oxygen delivery to muscles during periods of elevated cellular respiration. This is evidenced by the fact that myoglobin, a monomer with no allosteric, does not exhibit the Bohr effect [12].

Hemoglobin mutants with weaker allosteric may exhibit a reduced Bohr effect. For example, in Hiroshima variant hemoglobinopathy, allosteric in hemoglobin is reduced, and the Bohr effect is diminished. As a result, during periods of exercise, the mutant hemoglobin has a higher affinity for oxygen and tissue may suffer minor oxygen starvation [13]. As blood nears the lungs, the carbon dioxide concentration decreases, causing an increase in PH. This increase in pH increases hemoglobin's affinity for oxygen through the Bohr effect, causing hemoglobin to pick up oxygen entering your blood from your lungs so it can transport it to your tissues.

Evolutionary Metabolic Hypothesis of Cancer (EMHC)

The first living cells on Earth are thought to have arisen more than 3.5 × 109 years ago, when the Earth was not more than about 109 years old. The environment lacked oxygen but was presumably rich in geochemically produced organic molecules, and some of the earliest metabolic pathways for producing ATP may have resembled present-day forms of fermentation. In the process of fermentation, ATP is made by a phosphorylation event that harnesses the energy released when a hydrogen-rich organic molecule, such as glucose, is partly oxidized. The electrons lost from the oxidized organic molecules are transferred via NADH or NADPH to a different organic molecule or to a different part of the same molecule, which thereby becomes more reduced. At the end of the fermentation process, one or more of the organic molecules produced are excreted into the medium as metabolic waste products. Others, such as pyruvate, are retained by the cell for biosynthesis. The excreted end-products are different in different organisms, but they tend to be organic acids. Among the most important of such products in bacterial cells are lactic acid which also accumulates in anaerobic mammalian glycolysis, and formic, acetic, propionic, butyric, and succinic acids [14].

The first cell on the earth before the entrance of the bacteria did contain nucleus and used the fermentation process to produce ATP for its energy. Then an aerobic proteobacterium enters the eukaryote either as a prey or a parasite and manages to avoid digestion. It then became an endosymbiont. As we observe, the fermentation process used the glucose or even glutamine to produce ATP, but the aerobic process used the glucose, fat and protein to produce more ATP than the previous one. The symbiogenesis of the mitochondria is based on the natural selection of Charles Darwin. Based on Otto Warburg Hypothesis, in nearly all cancer cells, the mitochondrion is shut down or are defected and the cancer cell do not use its mitochondrion to produce ATP [15]. This process of adaptation is based on Lamarckian Hypothesis of Evolution and the normal cells goes back to the most primitive time of evolution to protect itself from apoptosis and uses the fermentation process like the first living cells 1.5 billion years ago. Therefore, cancer is an evolutionary metabolic disease which uses glucose as the main food to produce ATP and Lactic Acid. The prime cause of cancer is the abundance of Reactive Oxygen Species produced by mitochondria that is a threat to the living normal cell and causes mitochondrial damage mainly in its cristae [17].

Conclusion

Cancer cells cause the body and the blood to become acidic through the production of lactic acid. Nearly all cancer patients' blood is acidic through the fermentation process of cancer cells. The specific keto-diet in combination with the vial ozone therapy increases the blood PH which is an important factor in absorbing more oxygen from the lungs through the Bohr Effect. Increasing the blood PH results in absorbing more oxygen and the acidity of the cancer tissues result in absorbing more oxygen from the blood. The keto-diet will force the cancer cells to apoptosis estate and the combination of the vial ozone therapy is the treatment of cancer.

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