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**Review Article**

Biological Effects of Magnetic Water on Human and Animals

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Abstract: The aim of the present study was to investigate the beneficial effects of magnetized water for human and animals. There was an improvement in water quality when exposed to the magnetic field with considerable change in the pH, total dissolved solids, total hardness, conductivity, salinity, dissolved oxygen, evaporating temperature, minerals, organic matter and total count of bacteria. Therefore it's penetration into cell wall would be facilitated which can accelerate ordinary diffusion of water that is vital for growth of different organs. Patients uses magnetic water for digestive, urinary and nervous problems, ailments like mastitis, pains and swellings, painful urination and many other disorders. Magnetized water has been found effective in alleviating colds, coughs, bronchitis, all types of fever and more, arthritis pain, reducing blood pressure, recovering quickly from a stroke, and it helpful in the regularization of women's menses. Also, treatment with magnetic water was very effective in breaking up kidney and gall bladder stones into small particles. The water also prevented further formation of stones in the kidneys and gallbladder. Magnetic water may prevent aging and fatigue by increasing the cell membrane permeability. Effectiveness of magnetized water in the prevention and treatment of atherosclerosis has been shown in some animal and human studies. It has been reported that magnetic water help unclog the arteries and veins of deposits of cholesterol and salts and normalize the circulatory system. Also, magnetized water can be helpful in weight control, as an adjunct to a correct diet because this water improves metabolic activity, it may be helpful in burning up excessive fatty tissue. Magnetized drinking water improves nutrient digestibility, saves water consumption, optimizing rumen fermentation parameters, and it could an effective way to reduce methane production and contributing to mitigate environmental impact in livestock, positive animal health, which is reflected in the increase in milk yield and its component and improves blood picture and antioxidant status. Magnetized drinking water caused increase milk production, mutton, and wool in sheep not only that, but more weight gain in geese and egg production and hatchability in turkey can be achieved, and increasing in milk yields in dairy cows and ewes. It can be concluded that magnetic water treatment improved blood picture, biochemical parameters, semen quality, and antioxidant status in human and animals. So, magnetic water must be used to mitigate the harmful effects of drugs, toxins, and environmental pollutant on human and animals.

Keywords: Animals, Antioxidant Status, Bioeffects, Histological Structure, Human, Magnetic Water, Physiological Aspects, Reproductive System

1. Introduction

Water is Paramagnetic meaning that it holds a magnetic charge. Para-magnetism occurs primarily in substances in which some or all of the individual atoms, ions, or molecules possess a permanent magnetic dipole moment. Water has a dipole moment and is, therefore, subject to paramagnetism [1,

2]. Magnetic water means passing water from magnetic tubes, by putting a magnet in water so properties of water turn into very fertile and active, causing high oxygen ratio, velocity of dissolved salts and amino acids in water. Natural water after sterilization is called dead water, so magnetic water transfer water from dead to live [3, 4]. There was an improvement in water quality when exposed to the magnetic field with considerable change in the pH, total dissolved solids, total

hardness, conductivity, salinity, dissolved oxygen, evaporating temperature, minerals, organic matter and total count of bacteria. The increase of salinity of water due to the magnetic exposure could be attributed to increasing soluble salts which concurred with the conductivity, while increasing dissolved oxygen could be due to the decrease in organic matter in magnetic water [5]. Physics shows that water changes weight under the influence of magnetic fields. More hydroxyl (OH⁻) ions are created to form alkaline molecules, and reduce acidity. Increasing both the electric conductivity and the dielectric constant of water was documented [2, 5, 6]. Normal water has a pH level of about 7, whereas magnetized water can reach pH of 9.2 following the exposure to 7000 gauss strength magnet for a long period of time [2, 7].

Exposing of water to strong magnetic fields affected the mineral content of water and its effects depended on the strength of the magnetic field and exposure time. Nowadays, the use of magnets to improve water quality is of significant interest due to low cost compared to chemical and physical treatments [5]. Water solution passes through magnetic field acquire finer and more homogeneous structures, which increases the fluidity, dissolving capability for various constituents like minerals and vitamins and consequently improves the biological activity of solutions, affecting positively the performance of animals [2, 8]. Using magnetically treated water offered improvements in industry and agriculture such as scale reduction and increased crop yields [9, 10]. Researchers found when a permanent magnet is kept in contact with water for a considerable period of time; water gets magnetically charged and acquires magnetic properties. Such magnetically treated water has its effect even on the human body when taken internally and regularly for a considerable period of time [2, 7]. Surface tension in magnetized water is reduced by 10-12% whilst its velocity is increased in compare with regular water. Therefore it's penetration into cell wall would be facilitated which can accelerate ordinary diffusion of water that is vital for growth of different organs [11, 12].

Magnetized water was first used in Russia by three specialists: Drs. G. Gerbenshchikow, I. Shetsov and K. Tovstoles, all three specialists in urology at the Kirov Military Medical Academy in Leningrad. They had their patients drink bi-polar magnetized water. This simple treatment was very effective in breaking up kidney and gall bladder stones into small enough particles to be passed through urine without any pain or danger to the patient. The water also prevented further formation of stones in the kidneys and gallbladder. Soviet physicians have been giving internally magnetized water to patients for over 30 years for digestive, urinary and nervous problems, ailments like mastitis, pains and swellings, painful urination and many other disorders [13, 14]. There was a report of people resolving bladder problems, recovering quickly from a stroke, alleviating arthritis pain and reducing blood pressure by drinking magnetized water [15]. Magnetic water may prevent aging and fatigue by increasing the cell membrane permeability [16]. Effectiveness of magnetized water in the prevention and treatment of atherosclerosis has

been shown in some animal and human studies [16-19]. It has been reported that magnetic water help unclog the arteries and veins of deposits of cholesterol and salts and normalize the circulatory system. Magnetized water has been found effective in alleviating colds, coughs, bronchitis, all types of fever and more, and it helpful in the regularization of women's menses [14, 20]. Also, magnetized water can be helpful in weight control, as an adjuvant to a correct diet because this water improves metabolic activity, it may be helpful in burning up excessive fatty tissue [14, 21].

Yacout *et al.*, [5] concluded that magnetic water treatment for Zairaibi goats resulted in improved water quality which consequently improves nutrient digestibility, saves water consumption, optimizing rumen fermentation parameters, and it could an effective way to reduce methane production and contributing to mitigate environmental impact in livestock, positive animal health, which is reflected in the increase in milk yield and its component and improves blood picture and antioxidant status. Magnetic drinking water caused increase milk production, mutton, and wool in sheep not only that, but more weight gain in geese and egg production and hatchability in turkey can be achieved, and increasing in milk yields in dairy cows and ewes [5, 22, 23]. Al-Fadul, [24] concluded that the magnetization of water improves the water properties, which consequently improves the growth performance, feed efficiency and saves water consumption for broilers. Attia *et al.*, [25] concluded that magnetic treatment improved water quality, semen quality, blood picture and antioxidant status and hence buck fertility. It has been demonstrated that intake of magnetized water result in reduced DNA damage [12, 26]. In zairaibi goats, magnetic treatment could improve water quality and consumption, feeding value, ruminal fermentation, blood picture, antioxidant status and hence milk and labneh yields especially with 3600 gauss [5]. Cows drinking magnetized water produced more milk and were healthier than cows drinking untreated water. Sheep produced more wool and meat, hens laid more eggs and all farm animals survived longer when drinking magnetized water [27]. Most of the previous literatures studied the effects of magnetic water on organs of a certain animal, but few of them, which studied the beneficial effects of magnetic water on different organs in animals, and human. Also, to our knowledge, the evidence reporting the effect of magnetic water on human and animals is hardly found. So, the present review aimed to investigate the beneficial effects of magnetized water for human and animals.

2. Effect of Magnetic Water on Feed Intake, Water Consumption and Body Weight

Attia *et al.*, [25] reported that rabbit bucks drank magnetized water showed a significant increase in body weight, feed intake. Also, Yacout *et al.*, [5] recorded that zairaibi goats consumed magnetic water (field of 1200 and 3600 gauss) showed a significant increase feed intake and water consumption. On the other hand, Feed consumption

showed no significant changes, while metabolic factor increased and body weight decreased only among magnetically treated water group animals, the highest improvement was recorded in water consumption in magnetically treated water groups. Magnetically treated water makes animals thirsty could be used as a strategy to enhance body hygiene and immune system [28].

3. Effect of Magnetic Water on Milk Yield and Composition

The daily milk yield of Zaraibi goats, dairy cattle, ewes, and Awassi sheep consumed magnetic water was significantly higher than control groups [5, 23, 29, 30]. This increase in milk production may be attributed to the outcome of the positive impact of magnetic water on digestion, absorption, growth of cells and their functions, circulatory system and udder [5, 31, 32], increasing in the secretion of the prolactin hormone through the effect of the endorphins hormone, which increases the stimulation and thus lead to an increase in milk production [5, 33].

Improvement in milk yield was associated with an increase in fat and protein production in animals consumed magnetic water [5, 23, 29, 30, 34]. It may be due to the amount of milk protein is directly proportional to the amount of milk produced, or to an improvement in increasing the digestion of crude protein, where drinking magnetic water works to an increase in small intestines movement and increase the processes of digestion and absorption [5, 35], or to a decrease in the melatonin hormone, which leads to an increase in the (IGF-1) Insulin-like growth factor-1 or may lead to an increase in the secretion of prolactin hormone and this increase are important in the secretion of milk [5, 36, 37].

4. Effect of Magnetic Water on Haematological Parameters

Animals received magnetic water showed a significant increases in red blood cells count, and hemoglobin concentration [5]. Also, Al-Nuemi *et al.*, [4] recorded that holstein bulls treated with magnetic water showed a significant increases in red blood cells count, packed cell volume and hemoglobin concentration of treated bulls for age 17-18 and 29-32 month compared with control. Increasing the RBC's count has attributed to increase the intensity of water processor magnetically to that the magnetic field works on iron attract in the blood and then connect the blood in larger quantities to the area causing an increase the number of RBC's and hemoglobin concentration and therefore carried oxygen more to cells [4,5, 38]. A significant increase in RBC could be attributed to magnetic water causing increased production and transferred large amount of RBC and to elaborate blood vessel and increase in movement of RBC to changes of nutrition and transferred of oxygen to cells [4, 23, 39, 40]. The improvement in metabolic profiles could be attributed to enhancing metabolic cycles, minerals solubility such as Fe

and/or Cu as evidenced by increasing RBCs and Hb and nutrients transfer to various body cells, movement of blood within the arteries facilitating the transport of oxygen bearing blood and nutrients to different body cells [5, 41].

Raafat, and Nabil, [14] concluded that magnetic treated water enhanced the normal hemoglobin derivatives and decrease the non-function hemoglobin form so it improve the overall hemoglobin health. Hemoglobin molecule is formed from four globin parts surround a heme atom in the center of this structure. The magnetic properties of the hemoglobin that controls the binding process of hemoglobin with oxygen and carbon dioxide many depends on this magnetic field generated around the heme atom. By generating many of free radicals the unpaired electron molecules reach to the heme atom revealing oxidation process in which heme is highered from ferrohemoglobin to ferric hemoglobin. In ferric hemoglobin heme atom is in the higher electronic state which make the affinity of oxygen very low. Treatment with magnetic treated water improved the surrounding magnetic field of the water molecule and enhanced the overall reaction carried out depending on this property. Enhancement of the normal oxyhemoglobin in which heme atom is in the ferro state is an indication of the hemoglobin health [14]. Treatment of buck and ram with magnetic water caused a significant increase in PCV and Hb [23, 42, 43]. Magnetic water were induced a significant increase in Hb in lambs, ewes and in fish [44-46]. Treatment with magnetic water caused a high potential in the processing of the body's cells and tissues of different nutrition appropriate to perform its best of its biological, leading to the lifting capacity of organs and tissues hematopoietic like liver, kidney and spleen, to produce blood [4, 33, 47]. Also due to increase in metabolic reactions in the tissues, raising hormone which works to increase the production of RBC and thus increases PCV [4, 48, 49]. The increment of PCV and Hb may be attributed to increase in production of these cells from bone marrow, circulatory system under the effect of hormonal factors [4, 50] or improves the immune system of animals [4, 51] or decreases viscosity of blood and increase movement of blood in vessels which caused high movement of Hb [4, 52].

Animals received magnetic water showed a significant increase in white blood cells count [4, 5]. The increase in the whit blood cells count may be due to increase the severity of the water processor magnetically to increase the emergence of these cells configured sites in the bone marrow into the circulatory system by the impact of some hormonal factors [5, 50], increase in body immunity through the increased proportion of lymph cells which may be due that magnetic water increases the content of immune globulin in the blood and increase the number of defensive white blood cells [5, 53].

5. Effect of Magnetic Water on Biochemical Parameters

Yacout *et al.*, [5] reported that Zaraibi goats drank magnetic water showed a significant increase in glucose level compared with drank unmagnetic water. On the other hand, the study of

Alhammer *et al.*, [28] showed that magnetically treated water significantly decreased the glucose level. This may be attributed to magnetically treated water has increased the water conductivity, this may increase the blood circulation and by which increases the glucose uptake by the cells [28, 54, 55].

Rabbits treated daily for 60 days with magnetic water showed a significant increase in serum concentration of high density lipoprotein- cholesterol, and a significant decrease in serums total cholesterol, triacylglycerol, low density lipoprotein - cholesterol, and very low density lipoprotein cholesterol concentrations [2]. Also, Zaraibi goats drank magnetic water showed a significant decreased in cholesterol concentration as compared with control group [5]. This may be due to interaction with moving charges and enzymes activities rates in cell-free systems increasing transcript levels for specific genes, or interacts directly with electrons in DNA to affect protein biosynthesis [5, 49]. Exposure to a low magnetic field decreased plasma peroxide level in stressed rats [56]. It is possible that EMF can ameliorate the deleterious effects of Free radicals by decreasing the chemical reactions that caused damage to DNA, proteins and lipids [2]. The antioxidant activity of magnetic water was claimed to be responsible for its hypolipidemic effect [2].

Drinking magnetic water had beneficial effect on some physiological aspects manifested by a significant elevation in total serum proteins of male rabbits, and bucks [2, 42]. The effect of magnetic water on total protein of blood may be differed from species to another and increase significantly in some components of blood without increase in others such as total protein [4]. Rabbits treated daily for 60 days with magnetic water showed a significant increase in serum total protein concentration [2]. Also, Zaraibi goats drank magnetic water showed a significant increase in total protein, albumin and globulin compared with drank unmagnetic water [5]. Elevation of blood total proteins by magnetic water treatment may play positive role in an increase in growth and the consumption of protein to build somatic cells [5, 57], and indicated maintenance of cellular functions, the change in protein metabolism and EMF also interacts directly with electrons in DNA to affect protein biosynthesis [2, 49, 58].

Goats received magnetic water showed a significant decreased ALT and AST (improvement of liver functions) when compared to those of goats that drank unmagnetic water [5]. On the other hand, no significant changes in both aspartate aminotransferase and alkaline phosphatase activities, and highly significant increased in adenosine deaminase activity were recorded in the magnetically treated water groups comparing to control group [28]. Since adenosine deaminase activity represents an immunological parameter, consumption of MTW may improve the immunological status. Magnetic treatment has claimed to help body against microbial invaders and improve immune system [28, 59].

Goats received magnetic water showed a significant decreased in urea (improvement of kidney functions) when compared to those of goats that drank unmagnetic water [5].

6. Magnetized Water and Oxidative Stress

Antioxidants are reducing agents, and limit oxidative damage to biological structures by passive free radicals [5, 60]. Antioxidant enzymes mainly SOD and CAT is the first line defensive against free radicals which cause oxidative damage in animal tissues. Catalase (CAT) is one of the most important intracellular enzymes in the detoxification of the oxidant hydrogen peroxide. Meantime, the activity of AT and SOD enzymes is inhibited with high level of toxic metabolites [5, 61]. Glutathione peroxidase (GSH-Px) is the most powerful antioxidant enzyme protects cellular proteins against reactive oxygen species (ROS) in the body [5, 62].

Several studies reported that magnetized water could influence effectively on the oxidant-antioxidant balance, for instance, it could decrease the amounts of malondialdehyde, increase the superoxide dismutase activity in the heart, kidney and liver and also decrease the amounts of nitric oxide which all result in decreasing oxidative stress [12, 26, 63-65]. Goats received Magnetic water showed a higher glutathione peroxidase (GSH-Px), catalase (CAT) and superoxide dismutase (SOD) compared to those of goats that drank unmagnetic water [5]. Rabbits treated daily for 60 days with magnetic water showed a significant increase in serum glutathione concentration [2].

7. Effect of Magnetic Water on Histological Structure of Heart, Lung and Spleen

Amer *et al.*, [66] reported that albino rats were given magnetized water with intensity of 250, 750, 1000, 1500 gauss every day for 30 days. Then the animals were sacrificed and the histological change on heart, lung and spleen was studied. Histopathology of heart in rats treated with magnetic water with intensity of 250, 750, 1000, 1500 gauss showed no clear pathological lesion. Lung section of rats treated with 250 gauss of magnetic water showed no pathological lesion, while lung section belongs to rats group given magnetic water with intensity of 750, 1000 gauss showed hyperplasia of lymphoid tissue in the wall of bronchiole and thickening to the wall alveoli, in addition the lung section belongs to magnetic water with intensity of 1500 gauss treated rats showed thickening in alveolar wall. Spleen tissue belongs to magnetic water with intensity of 250 gauss treated rats showed hyperplasia of the white pulp, while spleen tissue belongs to magnetic water with intensity of 750 gauss treated rats showed a marked hyperplasia of the lymphoid tissue in the periarterial sheath. Hyperplasia is an increase the number of cells mainly lymphocyte. This increase mainly stimulated by high intensities of magnetic water this result suggest that the interference by magnetic field with regulation of cellular Ca^{++} signals, the most important evidence in favor of this hypothesis includes correlation between the magnetic field induced Ca^{++} changes and the cellular activation status and

extent to which lymphocyte DNA synthesis is modified by magnetic field [66, 67]. Also, spleen tissue belongs to magnetic water with intensity of 1000 gauss treated rats showed amyloid like substance deposition around the white pulp. Necrotic area of lymphoid tissue was observed in the spleen tissue belongs to rat groups given magnetic water with intensity of 1500 gauss [66].

8. Effect of Magnetic Water on Reproductive System

Magnetic water can increase ability of body for production general and sexual hormones, transport of food in blood, and improved semen characteristics, fertility rate [4, 44, 68-70]. Attia *et al.*, [25] reported that rabbit bucks drank magnetized water showed a significant increase in fertility, sperm concentration, mass motility and total live sperm. The improvements in fertility and semen quality concurred with significant increases in testosterone hormone, immunoglobulin A, antioxidant enzymes, and with decreases in lipid peroxidation biomarker malondialdehyde and thiobarbituric acid-reactive substances [25]. The increase in testosterone due to magnetized water may have led to increased sexual desire as demonstrated by the decrease in the reaction time and the increase in fertility and semen quality [71]. Al-Nuemi *et al.*, [4] reported that holstein bulls treated with magnetic water showed a significant rise in testis dimensions and scrotal circumferences as compared with control bulls for age at 17-18 month. Also, a significant increase in testis dimension was recorded in magnetic water treated buck, and lambs [42, 72]. This benefit of magnetic water on testis dimension and scrotal circumferences may be this magnetic water enhance the digestion absorption of growth functions cell and circulating system [4, 31, 32], and increase the feed conversion efficiency by reducing the surface tension and increase the permeability of the cells, and this allows the expansion of the gut to take advantage of food and therefore, an improvement in the dimensions of the body [4].

Hafizi *et al.*, [12] investigated that the effects of magnetized water on height of epithelial cells in pre-implantation stage endometrium and fallopian tube and number of corpus lutea in female mice. Data analysis showed a significant increase in the mean number of corpus lutea and the height of epithelial cells in fallopian tube comparing the case with the control group whereas uterus epithelial cells of the case group showed insignificant increase in height, in compare with the control group. The potential hypotheses could be regarding to the effects of magnetized water on oxidative stress and cell growth which result in bio-activation improvement in epithelial cells. Magnetized water is probably effective in cell growth by increasing oxygen concentration, mineral solubility and accelerating transfer of water and nutrients in all compartments of body via improvement of permeability of cell wall as a consequence of decreased surface tension and electric conductivity [11, 12, 73]. The effect of magnetic field on intracellular fluid and substances results in enzyme

activation and increased biochemical reactions in the cell, the reduction of suspended solids and pathogenic bacteria is another assumable factor that can explain this result [12]. Regarding the role of fallopian tube epithelium in secreting colony stimulating factor 1 (CSF1), epidermal growth factor and interleukin 2, the effect of magnetized water on epithelial cells of the fallopian tube could be in favor of fertility. The uterine epithelial cells and corpus luteum play an essential role in the implantation phase. Increased number of corpus lutea in association with increased height of uterus epithelial cells may support the establishment of pregnancy [12].

9. Effect of Magnetic Water on the Bones

Neto *et al.*, [74] reported that the consumption of water treated by magnetic field for 45 d provided an effective way to improve the bone mineral density, bone mineral content, and bone resistance in Wistar rats.

10. Conclusion

It can be concluded that magnetic water treatment improved blood picture, biochemical parameters, semen quality, and antioxidant status in human and animals. Magnetic water very effective in breaking up kidney and gall bladder stones, and prevent further formation of stones in the kidneys and gallbladder. It alleviates arthritis pain and reducing blood pressure, prevention and treatment of atherosclerosis, help unclog the arteries and veins of deposits of cholesterol and salts and normalize the circulatory system, helpful in weight control. Also, it mitigate environmental impact in livestock, increase in milk yields and its component in dairy cows and ewes, mutton, and wool in sheep and improves blood picture and antioxidant status, more weight gain in geese and egg production and hatchability in turkey. So, magnetic water must be used to mitigate the harmful effects of drugs, toxins, and environmental pollutant on human and animals.

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