Effect of Magnetized Water on Histological Structure of Heart, Lung and Spleen of Albino Rats

Sura F. Al-Saffar[1*], Nusaibah Amer[2*], Lualuaa S. Zaki[*]
Ali S. Faris[**], Natheer J. Imran[**], Zainab F. Nadhim[**] and Raed I. Jaafar[**]

[*]Department of Biology, College of Science, University of Baghdad, Baghdad-Iraq.
[**]Ministry of Science and Technology, Baghdad-Iraq.
[1]E-mail: Sura_alsaffar@yahoo.com.
[2]E-mail: Nusaiba_histo@yahoo.com.

Abstract

The aim of the study was to investigate the effect of magnetized water on the histological structure of heart, lung and spleen. For this purpose, twenty five albino rats were divided into five equal groups, the first group was considered as control group. The other groups were given magnetized water with intensity of 250, 750, 1000, 1500 gause 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 gause showed no clear pathological lesion. Lung section of rats treated with 250 gause of magnetic water showed no pathological lesion, while lung section belongs to rats group given magnetic water with intensity of 750, 1000 gause 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 agues treated rats showed thickening in alveolar wall. Spleen tissue belongs to magnetic water with intensity of 250 gause treated rats showed hyperplasia of the white pulp, while spleen tissue belongs to magnetic water with intensity of 750 gause treated rats showed a marked hyperplasia of the lymphoid tissue in the periarterial sheath. Also, spleen tissue belongs to magnetic water with intensity of 1000 gause 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 gause.

Keywords: magnetic water, heart, lung, spleen, rats.

Introduction

Water is most biological important substance, it's essential to solubilize and modified the properties of biomolecules such as nucleic acids, proteins and carbohydrates by forming hydrogen bonds with their polar functional groups [1].

Water is diamagnetic; however, its biophysical properties can be affected by magnetic field [2, 3]. There are three natural

conditions are created in naturally magnetized water which give this water its unique qualities: it's contain balance of essential minerals, and water molecules would be more organized in structure and movement, forming smaller clusters and allows it to be more easily absorbed and utilized by cells, also it has slightly higher alkaline pH [4].

Liu *et al* and Coey and Cass published research in 2010 and 2000 [5,6] demonstrating that magnetic treatment causes water containing mineral to favor formation of more soluble calcium aragonite over calcium carbonate and resulting removal of calcium carbonate deposits from steel substrate.

Important fact of physiological function is the role of magnetism in the body in creating and maintaining an energy field. The body flourishes in an electro-chemical environment, which is activated by its response to magnetism [7]. The electromagnetic energy and the body has a valid and important relationship [8], in which water magnetic properties react with the body's magnetic influence will enhance in way the body maintains a state of balance along with its efficient use of energy [9,10].

Magnetization is water exposure to magnetic field which cause changes in microscopic structure and macroscopic properties of water, these changes were determined by infrared, visible, ultraviolet and

x-ray spectrum which described by displacements and polarization of molecules and atoms and result in changes of dipole moment in transition and vibrational state of molecule ,thus the distribution of molecules and the transition probability of valance, bounded and molecules inner layer of electrons are varied but the constitution of molecules and atom do not alter in such case, while the macroscopic properties like surface tension force and water hydrophobicity of materials decrease after magnetization, the viscosity of magnetized water increase with decreasing of intensity of magnetic field and magnetization time [11, 12].

Magnetized water is claimed to be energy-building, activating, cleansing and detoxifying. There are reports of people resolving bladder problems, recovering quickly from a stroke, alleviating arthritis pain and reducing blood pressure by drinking magnetized water. It is perhaps reasonable to assume that if scientific studies on animals have proven that magnetized water has health benefits, then it should also be beneficial to humans. However, so far there have been no systematic, clinical trials done to prove or disprove the healing effects of magnetized water in humans [13, 14, and 15].

More recently, electromagnetic (low Hz to kHz frequencies) radiation was successfully applied in bone healing and osteoporosis treatment, with several FDA approved treatments, Tendons and muscles after sports injuries [16] also seem to heal faster, with less pain and swelling.

Methods / Experimental Work

Water magnetization: tap water was magnetized by device designed by Ministry of Science and Technology, composed of plastic pipe surrounded by annular magnet with different intensity 250,750,1000 and 1500 gause, then water was collected after treatment with this device and given to experimental animals [17] .

Animals: 25 albino rats, 3-4 months old and 200-220 g body weight were housed in cages and maintained under laboratory controlled of temperature (25±2 ◦C), pelleted food *ad libitum*.

Experimental design: The animals were divided into five groups each of 5 rats for 30 days. The first group was considered as control group.

The second group was given magnetized water with intensity of 250 gauss, the third group was given magnetized water with intensity of 750 gauss, and the fourth group was given magnetized water with intensity of 1000 gauss, the fifth group was given magnetized water with intensity of 1500 gauss.

Histological examination**:** Animals were killed and small piece of heart, lung and spleen tissues were taken and were fixed in 10% neutral formalin, alcohol-dehydrated, paraffin-embedded and the section to mean thickness of 4 µm. The histological examination was evaluated by assessing the morphological changes with hematoxylin and Eosin (H&E) stains [18].

Results and Discussion

Every particle, atom, molecule, organelle, cell, tissue, organ and whole organisms resonates at its own particular frequency. EEG measurements show that the field generated by the human brain has frequencies in the extremely low (ELF) region centering around 7-8 Hertz. It naturally resonates to, and is entrained by the earth's resonant field (the Schumann Resonance), but can also be entrained by artificially generated fields of the appropriate frequencies. (This is the basic theory behind the Pacer). This entrainment effect can occur in every cell, organ and system of the body.

Certain bodily effects can be caused by applying magnetic fields which resonate to those certain biological frequencies. Thus events could be triggered which effect conformation of the body's molecules, alter rates of cellular, enzymatic or organic processes, alter chemical processes or just effect overall changes within the body [19].

The present study showed some histopathologicl effects in heart, lung and spleen tissues, histological examination of the normal control heart, tissues showed normal histology (Fig.(1)). A sectional view of magnetic water with intensity of 250, 750, 1000, 1500 gause treated rats showed no clear pathological lesion in heart (Fig. (2, 3, 4, 5)). Low frequency magnetic fields are widely used in electrical appliances and different equipment such as television sets, computers

and kitchen appliances. Recently, ELF-MF have been considered to be a therapeutic agent and have started to be more commonly used in medicine[20], while some studies have investigated whether exposure to a magnetic field (MF) poses a risk for cardiovascular morbidity and mortality [21, 22].

A statistically significant relationship was found between exposure to magnetic field and reduced heart rate variability, which leads to certain disorders such as acute myocardial infarcts and cardiac arrhythmia [23]; Other study [24] coordinate with our study which pointed out to effect of electromagnetic field on heart ultrastructure which observed normal cellular and mitochondrial structure and intercalated discs degeneration and apoptosis of nucleus were not seen.

Also, the results showed normal histology of the normal control lung tissue (Fig.(6)). In lung tissue belongs to magnetic water with intensity of 250 gause treated rats showed no pathological lesion (Fig.(7)), while lung tissue belongs to magnetic water with intensity of 750, 1000, gause treated rats showed hyperplasia of lymphoid tissue in the wall of bronchiole (Fig.(8, 9)) 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 [25].

Currently, only verylittle can be said about how an EMF acts to modify Ca regulation at the molecular level: there are many possible pathways starting with an interference of the field with ligand-receptor binding as proposed by Chiabrera *et al.* [26]. Theoretically many different steps in the signal transduction cascade subsequent to ligand-receptor coupling, e.g., phosphorylation-dephosporylation events that act as effectors of selected intracellular responses, could be targets of the field action. No data yet exclude any of these possible interactions. For example, some data suggest that EMF-altered proto-oncogene expression could be involved in field interactions with cell signaling processes [27]. The work using the Ca channel antagonist verapamil would indicate that EMF effects on Ca2 channels could be important in eliciting cellular field responses [28, 29, 30, 31]. Also, an EMF could alter the activity of the membrane-incorporated Ca24-ATPase responsible for pumping Ca2 out of the cell. Although this possibility has not been directly tested, data from two laboratories demonstrate that the activity of another membrane ion pump, Na/K4-ATPase, can be influenced by low-frequency electric fields [32, 33].The lung tissue belongs to magnetic water with intensity of 1500 agues treated rats showed thickening to the wall alveoli (Fig.(10)).

The mechanisms are not well known yet, but several theories have been proposed, including biochemical changes or altered enzyme activities by Phirke et al. [34]. Magnetic field is known as an environmental factor which affects gene expression. Therefore, augmentation of biological reactions like protein synthesis, biomass would increase too. Moreover, transcriptional factors are under effect of magnetic field stimulation [35].

The results showed normal histology of the normal control spleen tissue (Fig.(11)).In spleen tissue belongs to magnetic water with intensity of 250 gause treated rats showed hyperplasia of the white pulp (Fig.(12)).

While spleen tissue belongs to magnetic water with intensity of 750 gause treated rats showed there is marked hyperplasia of the lymphoid tissue in the periarterial sheath (Fig.(13)). this hyperplasia may be refer to main feature of magnetic water that reduce surface tension [36] which facilitates its penetration of cell wall and this could accelerate the normal division of cells or by magnetic water action to increase hormonal action [37].

Also, spleen tissue belongs to magnetic water with intensity of 1000 gause treated rats showed the main lesion characterized by hyperplasia around the air way which appeared as lymphoid follicle and myeloid like substance deposition around the white pulp (Fig.(14)). Amyloid like substance deposition around the white pulp amyloid like

substance around the white pulp which leads to depletion of white pulp Amyloid is a febrile glycoprotein material which lay down in the tissue usually extracellular. Amyloidosis is occurring as result to disturbance in protein metabolism and causative factors are still unknown [38], while Curren and Croker mention this condition associated with chronic inflammation like rheumatoid arthritis and by toxic compounds [39].

The spleen tissue belongs to magnetic water with intensity of 1500 gaues treated rats showed necrotic area of lymphoid tissue (Fig.(15)). Necrosis is dead cells in live tissue [40] which refers to harmful effects of high intensity of Magnetic water on spleen tissue. A further area of interest is whether static magnetic fields cause DNA damage, which can be evaluated by determination of the frequency of micronucleus formation. The presence or absence of such micronuclei can confirm whether a particular treatment damages cellular DNA [19], other study coordinate with us which mentioned that low frequency magnetic field (200 gause) could cause decrease with viable spleenocyte also numbers of WBC like lymphocyte, neutrophil and monocyte [41].

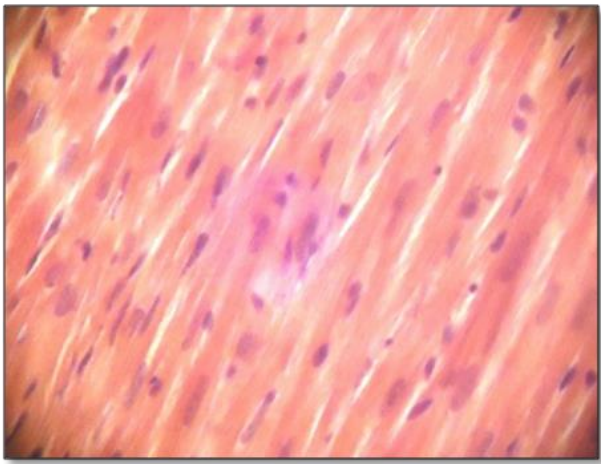

Fig. (1) Section in heart tissue belongs to normal control rat showing normal structure of heart muscle. (H&E) 100X.

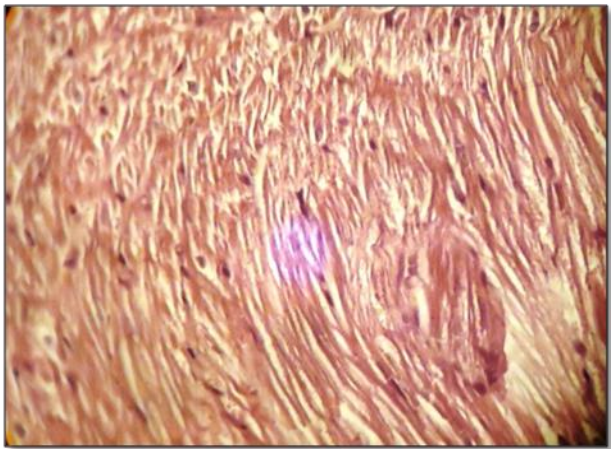

Fig. (2) Section in heart tissue belongs to rat treated with 250 gause of magnetic water showed no clear pathological lesion (H&E) 100X.

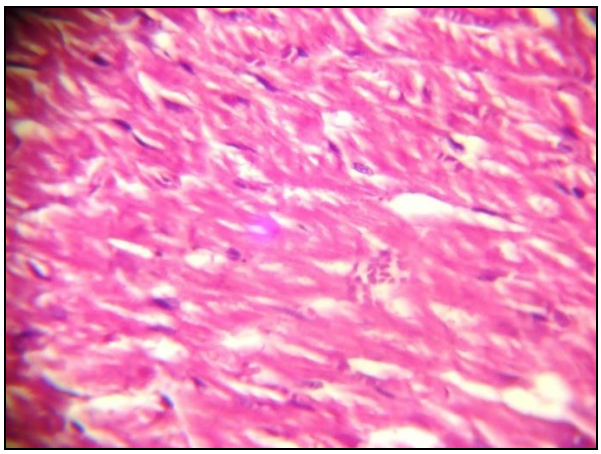

Fig. (3) Section in heart tissue belongs to rat treated with 750 gause of magnetic water showed no clear pathological lesion (H&E) 100X.

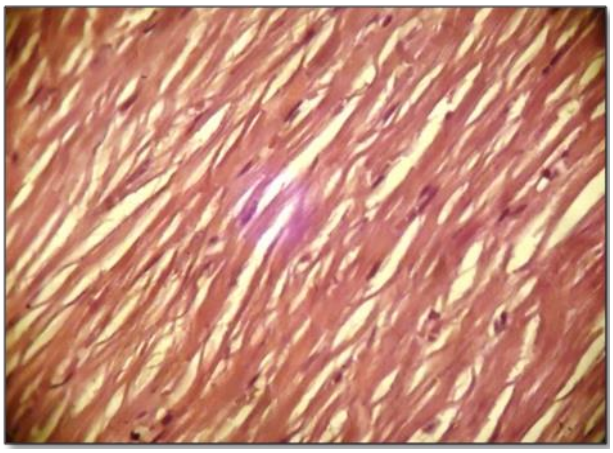

Fig. (4) Section in heart tissue belongs to rat treated with 1000 gause of magnetic water showed no clear pathological lesion (H&E) 100X.

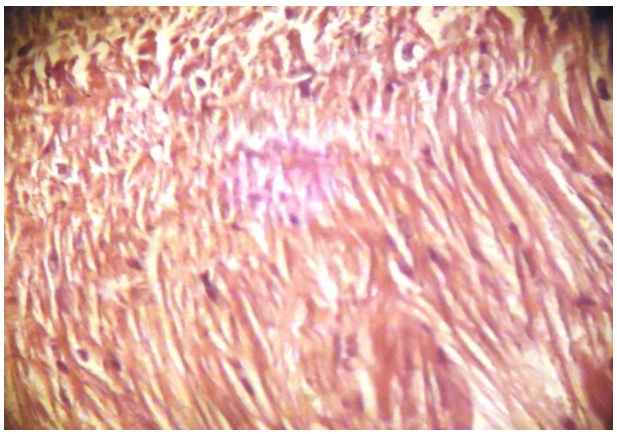

Fig. (5) Section in heart tissue belongs to rat treated with 1500 gause of magnetic water showed no clear pathological lesion (H&E) 100X.

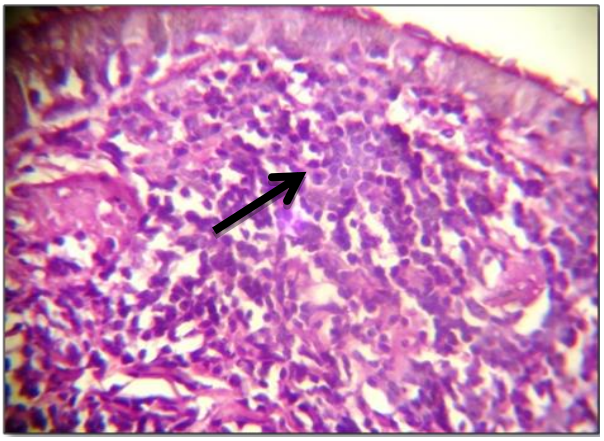

Fig. (8) Section in lung tissue belongs to rat treated with 750 gause of magnetic water showed ( ) hyperplasia of lymphoid tissue in the wall of bronchiole (H&E) 400X.

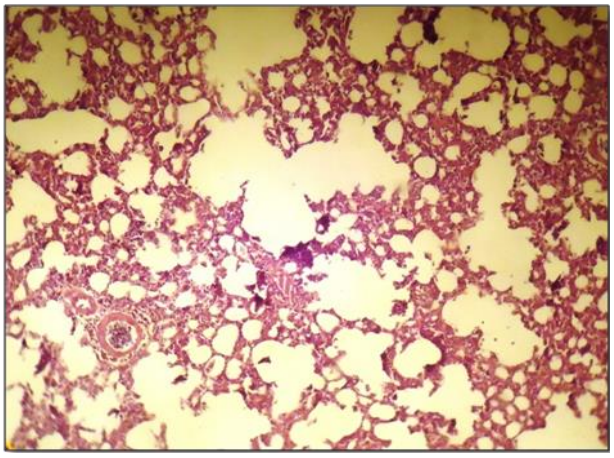

Fig. (6) Section in lung tissue belongs to control rat showed normal structure of alveolar and alveolar wall (H&E) 100X.

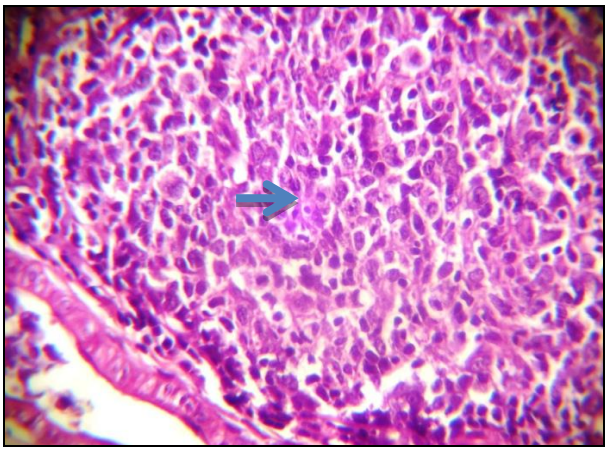

Fig. (9): Section in lung tissue belongs to rat treated with 1000 gause of magnetic water showed the main lesion characterized by hyperplasia around the air way which appeared as lymphoid follicle( )(H&E) 400X.

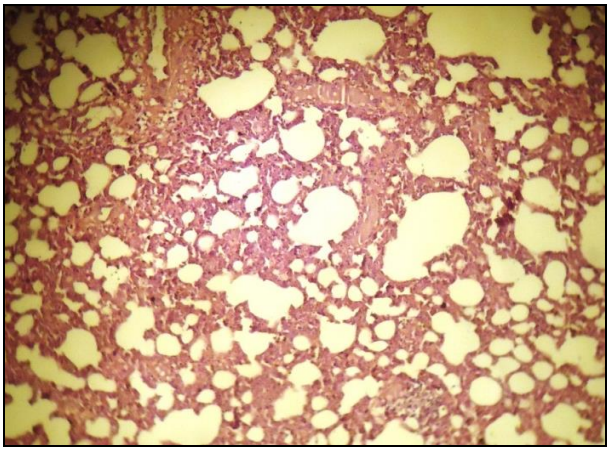

Fig. (7) Section in lung tissue belongs to rat treated with 250 gause of magnetic water showed no clear pathological lesion (H&E) 100X.

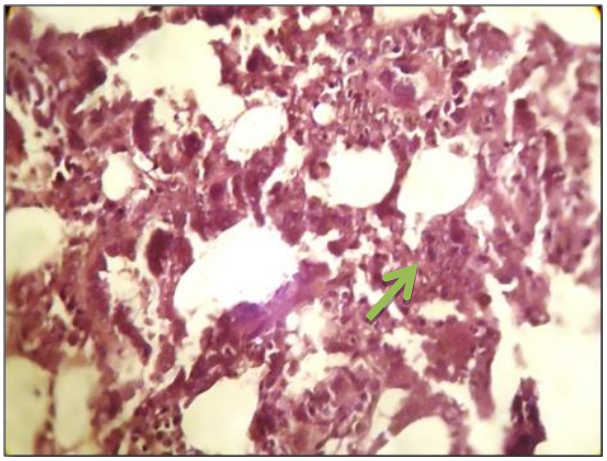

Fig. (10) Section in lung tissue belongs to rat treated with 1500 gause of magnetic water showed thickening to the wall alveoli ( ) (H&E) 400X.

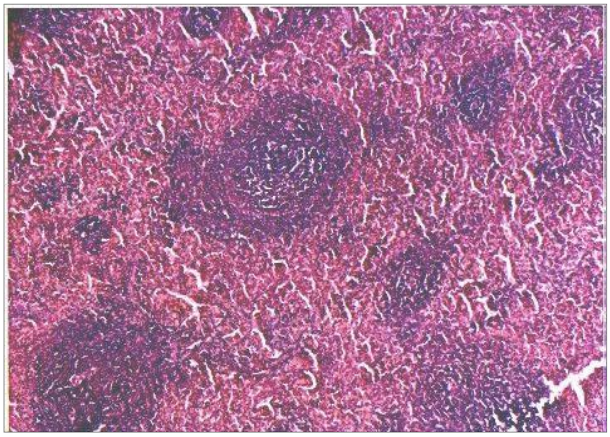

Fig. (11) Section in spleen tissue belongs to control rat showed normal white pulp and normal red pulp (H&E) 100X.

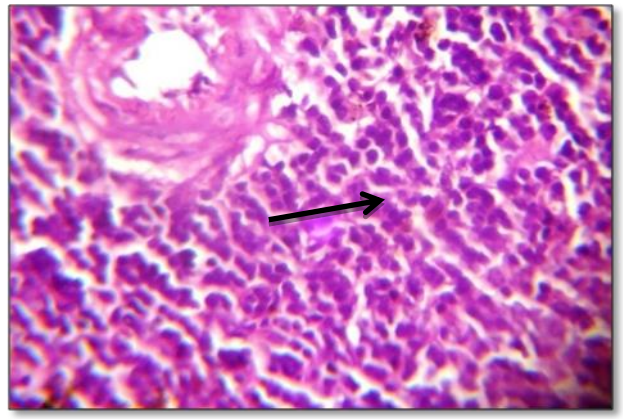

Fig. (12) Section in spleen tissue belongs to rat treated with magnetic water with intensity of 250 gause treated rats showed hyperplasia of the white pulp (⟶) (H&E) 400X.

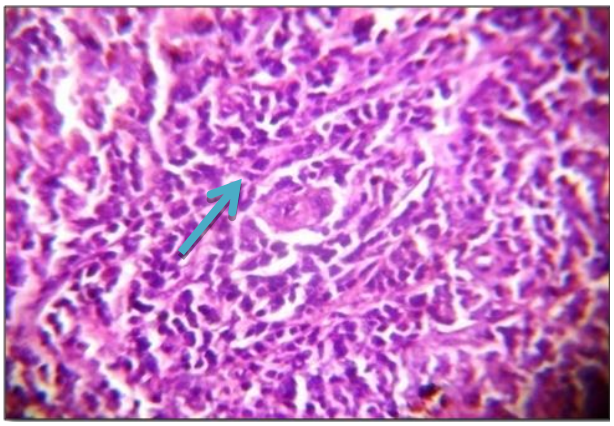

Fig. (13) Section in spleen tissue belongs to rat treated with 750 gause of magnetic water showed there is marked hyperplasia of the lymphoid tissue in the periarterial sheath (⟶) (H&E) 400X.

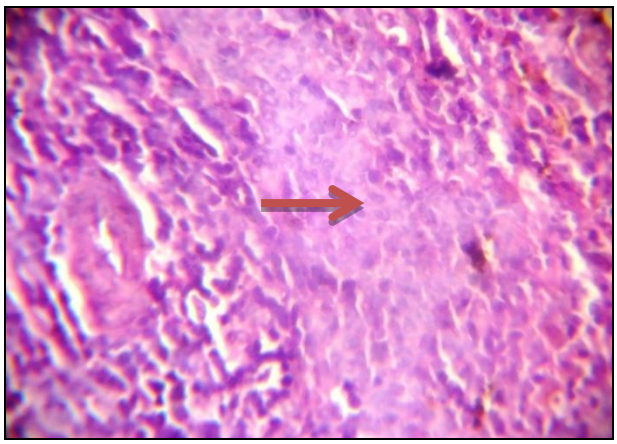

Fig. (14) Section in spleen tissue belongs to rat treated with 1000 gause of magnetic water showed amyloid like substance deposition around the white pulp (⟶)(H&E) 400X.

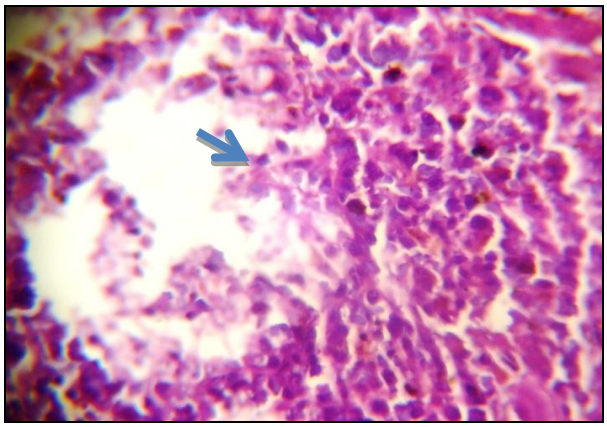

Fig. (15) Section in spleen tissue belongs to rat treated with 1500 gause of magnetic water showed necrotic area of lymphoid tissue (⟶) (H&E) 400X.

References

[1] Jerman, I., Berden, M. and Ruzic, R. "Biological influence of ultraweak supposedly EM radiation from organisms mediated through water", Electro-Magnetobiology. 15 (3): 229-244, 1996.

[2] Rai, S., Singh, N.N. and Michra, R. N. "Magnetic restructuring of water", Biology Engineering Computers. 32: 614-617, 1994.

[3] Rai, S. and Singh, A. K. "X-ray determination of magnetically treated liquid water structures", Electro Magnetobiology, 14 (2): 23- 30, 1995.

[4] Ohno, Y., Hatabu, H., Higashino, T., Nogami, M., Takenaka, D., Watanabe, H., Van Cauteren, M., Yoshimura, M.,

Satouchi M., Nishimura, Y., Sugimura, K. Oxygen-enhanced, M. R. "imaging: correlation with postsurgical lung function in patients with lung cancer", Radiology. 236: 704–711, 2005.

[5] Liu, C. Z., Lin, C.H, Yeh. M.S., Chao, Y. M., Shen, P. "Surface Modification and Planar Defects of Calcium Carbonates by Magnetic Water Treatment". Nanoscale Res Lett. 5 (12):1982-1991, 2010.

[6] Coey, J. M. D. and Cass, S. "Magnetic water treatment", Journal of Magnetism and Magnetic Materials, 20(9): 71-74, 2000.

[7] Kronenberg, K. "Experimental Evidence for Effects of Magnetic Fields on Moving Water", IEEE Transactions on Magnetics. 21(5): 2059-2061, 1985.

[8] Cope, F.W. "Magnetic Currents in Flowing Water: Implications for Magnetic Water and For the Immune Processes". Journal of Physiology, Chemistry and Physics, 12: 21-29, 1980.

[9] Smith, C.W. "Electromagnetic and Magnetic Vector Potential: Bio-Information and Water, in Ultra High Dilution". Physics and Physiology, Endler, P.C., Schulte, J, eds., Dordrecht, Austria: Kluwer Academic Publishers. 5: 187-200, 1994.

[10] Smith, C.W. "Electromagnetic Effects in Humans, in Biological Coherence and Response to External Stimuli". Frohlich, H., ed. Berlin: Springer-Verlag. 205-232, 1982.

[11] Xiao-feng, P. "The conductivity properties of protons in ice and mechanism of magnetization of liquid water", The European physical Journal. 49 (1):5-23, 2006.

[12] Xiaofeng P.; Deng B. "Investigation of changes in properties of water under the action of magnetic field". Applied Superconductivity and Electromagnetic Devices, 2009. ASEMD 2009. International Conference in Chengdu.: 278 – 283, 2009.

[13] Gursche, Siegfried and Rona, Zoltan. "Encyclopedia of Natural Healing". Alive Publishing, Inc., Burnaby, Canada, 400-407, 1997.

[14] Lednyiczky Gabor and Nieberl, Jozsef. "Biological resonance and the state of the organism. In Potentiating Health and the Crisis of the Immune System". Edited by Mizrahi, et al. Plenum Press, NY. 22:341, 1997.

[15] Noran, R. Shani, U. and Lin, I. "The Effect of irrigation with magnetically treated water on the translocation of minerals in the soil", Magn. Electr. Separ. 7(2):109-122, 1996.

[16] Commoner, B. Heise, J.J. and Townsend, J. "Light-induced paramagnetism in chloroplasts". Proc. Natl. Acad. Sci. USA. 42: 710-14, 1956.

[17] Xiao-Feng P. and Deng Bo. "The changes of macroscopic features and microscopic structures of water under influence of magnetic field". Physica 40 (3): 3571-3577, 2008.

[18] Bancroft, J.D. and Stevens, A. "The theory and practice of histological techniques". 2nd Ed. Williams Clews limited, Beccles and London pp: 116-613, 1982.

[19] Miyakoshi, J. "The review of cellular effects of a static magnetic field". Science and Technology of Advanced Materials. 7: 305–307, 2006.

[20] Goraca, A.; Ciejka, E. & Piechota, A. "Effects of extremely low frequency magnetic field on the parameters of oxidative stress in Heart". J. Physiol. Pharmacol., 61(3):333-8, 2010.

[21] Håkansson, N.; Gustavsson, P.; Sastre, A. &Floderus, B. "Occupational exposure to extremely low-frequency magnetic fields And mortality from cardiovascular disease". Am. J. Epidemiol., 158 (5): 34-42, 2003.

[22] Sorahan, T., Nichols, and L. "Mortality from cardiovascular disease in relation to magnetic field exposure: Findings from a study of UK electricity generation and transmission workers". 1973-1997. Am. J. Ind. Med. 45:93-102, 2004.

[23] Savitz, D. A.; Liao, D.; Sastre, A.; Kleckner, R. C. & Kavet, R. "Magnetic field exposure and cardiovascular mortality among electric utility workers". Am. J.Epidemiol., 149 (2):135-42, 1999.

[24] Söker, S., Sert, C., Deniz, M., Tekmen, I., Akkus¸ M. and Nergiz, Y. "The Effects of Electromagnetic Fields on the Ultrastructure of Heart". Int. J. Morphol. 29 (3): 960-964, 2011.

[25] Walleczek, J. "Electromagnetic field effect on cells of immune system: the role of calicium signaling", The FASEB Journal. 6:3177-3185, 1992.

[26] Chiabrera, A., Grattarola, M., and Viviani, R. "Interaction between electromagnetic fields and cells: microelectrophoretic effect on ligands and surface receptors", Bioelectromagnetics. 5:173-.190, 1984.

[27] Goodman, R., Wei, L.-X., Xu, J.-C., and Henderson, A."Exposure of human cells to low-frequency electromagnetic fields results in quantitative changes in transcripts". Biochim. Biophys. Acta 100 (9): 216-2201, 1989.

[28] Conti, P., Gigante, G. E., Alesse, E., Cifone, M. G., Fieschi, C., Reale, M., and Angeletti, P. U. "A role for calcium in the effect of very low frequency electromagnetic field on the blastogenesis of human lymphocytes", FEBS Lett. 181: 28-32, 1985.

[29] Conti, P., Gigante, G. E., Cifone, M. G., Alesse, E., Fieschi, C.and Angeletti, P. U. "Effect of electromagnetic field on two calcium dependent biological systems", J. Bioelectr. 4:227-236, 1985.

[30] Cadossi, R., Emilia, G., Ceccherelli, G., and Torelli, G. "Lymphocytes and pulsing magnetic fields". In Modern Bioelectricity (Marino, A. A., ed.) Dekker, New York pp. 451-496, 1988.

[31] Papatheofanis, F J. "Use of calcium channel antagonists as magnetoprotective agents", Radiat. Res. 122:24-28. 1990.

[32] Blank, M., and Soo, L. "Ion activation of the Na, KATPase in alternating currents". Bioelectrochem. Bioenerg. 24: 51-61, 1990.

[33] Serpersu, E. H., and Tsong, T. Y. "Activation of electrogenie Rb transport of (Na/K)-ATPase by an electric field". J.

Biol. Chem. 259:7155-7162, 1984.

[34] Phirke PS Kubde AB and Umbarkar, S. P. "The influence of magnetic field on plant growth". Seed Sci. Technol. 24: 375-392, 1996.

[35] Xi G., Fu Z.D. and Ling J. "Change of peroxidase activity in wheat seedlings induced by magnetic field and its response under dehydration condition". Acta. Bot. Sinica, 36: 113-118. 1994.

[36] Amiri, M.C. and Dadkhah, A.A. "On reduction in the surface tension of water due to magnetic treatment", Colloids and Surfaces". A: Physicochem. Eng. Aspects. 278 :252–255, 2006.

[37] Yi-Long, M. A.; Hui, R.; Shu. R.; Er-Kang, Z.; Gang, H. and You-wo, Z. "A study of the effect of magnetized water on enzyme activities by potentiometric enzyme electrode method". Journal of Tongii Medical university .12(4): 193-196, 1992.

[38] Anderson, W. A. D. "Pathology" .6th Ed. volume one .the C.V. Mosby company London.73-79, 1971.

[39] Curran, R. C. and Crocker, J. "Curran Atlas of Histopathology". Harvey Millered publishers oxford university press.195. 2005.

[40] Kumar, U., Cotran, R. S. and Robbins, S.L."Robbins Basic pathology". 7th (Ed). Saunders Comp , 4-781, 2003.

[41] Hossam, M.M., Arafa, A. R., Abd-Allah, A,. El-Mahdy, M. A., Ramadan, L. A., Hamada, M.A. "Immunomodulatory effects of L-carnitine and q10 in mouse spleen exposed to low-frequency high-intensity magnetic field". Toxicology, 187(2):171–181, 2003.

الخلاصة

الهدف من الدراسةِ هوالتحرّى عن تأثير المياه الممغنطة على التركيب النسجي للقلب والرئة والطحالِ. استخدم لهذا الغرض خمسة وعشرون جرذ ابيض قسمت الى خمس مجاميع متساوية، المجموعة الأولى إعتبرت مجموعة سيطرة. اما المجاميع الأخرى فقد أعطيت مياه ممغنطَة بشدة 250, 750, 1000, 1500 gause يومياً لمدة 30 يومِ. شرحت الحيوانات لدراسة التغيرات النسجية للقلب والرئة والطحال لم تظهر المقاطع النسجية للقلب في الجرذانِ المعاملة بالمياه الممغنطة بتراكيز 250, 750, 1000, 1500 gause تغيرات نسجية واضحِة. اما المقاطع النسجية للرئة في الجرذانِ المعاملة بالمياه الممغنطة 250 gause لم تظهر تغيرات مرضية، بينما اظهرت مقاطع الرئة للحيوانات المعاملة بالمياه الممغنطة بشدة 750 و 1000 و 1500 gause تضخّم في النسيج اللمفاوي لجدار القصيبة الهوائية وتثخن في جدار الحويصلات الهوائية. اما المقاطع النسجية للطحالِ في الجرذانِ المعاملةَ بالمياه الممغنطة 250 gause اظهرت تضخّم كمّي مِنْ اللبِّ الأبيضِ، بينما المقاطع النسجية للطحال المعاملةَ بالمياه الممغنطة 750,1000 gause اظهرت تضخّم كمّي ملحوظ مِنْ النسيجِ اللمفاويِ في المنطقة المحيطة بالشرينات وترسيب مواد تشبه النشا حول اللب الابيض وكذلك ظهرت اماكن تنخر في عدة اماكن من نسيج الطحال في الحيوانات المعاملة 1500 gause من المياه الممغنطة.