

The Antibacterial Effect of Magnetized Water on Oral Microorganisms

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الخلاصة

الأهداف: كان الهدف من الدراسة الحالية هو البحث عن تأثير وفائدة الماء الممغنط كغسول فموي. **المواد وطرائق العمل:** تم تحضير عينات من المياه الممغنطة باستخدام جهاز محلي الصنع بقوة مغناطيسية مختلفة؛ 500 و 850 و 1500 و 1900 غاوس؛ استخدم أربع مجموعات من الأشخاص الأصحاء بمعايير معينة (25 لكل مجموعة) 10 مل من الماء الممغنط لغرغرة الفم وإعطاء عينتين من اللعاب؛ قبل وبعد الغسل تم نقله إلى المختبر لحساب المستعمرات. **النتائج:** تم العثور على اختلافات كبيرة بين أعداد البكتيريا الفموية من عينات اللعاب الأساسية وبعد الغسل بالماء الممغنط مع قوة مغناطيسية مختلفة عند القيمة اقل اوبساوي 0.005. **الاستنتاجات:** نقترح استخدام الماء الممغنط كغسول للفم باعتباره طازجا ورخيصا ومتوفرا للوصول صحة فموية جيدة.

ABSTRACT

Aims: The purpose of this study was to investigate the effect of magnetized water as an oral irrigant. **Materials and Methods:** Samples of magnetized water were prepared using a locally made device at different magnetic strengths; 500, 850, 1500 and 1900 Gauss; four groups of healthy individuals with certain criteria (25 for each group) rinsed their mouth with 10 ml of the magnetized water and two saliva samples; before and after irrigation were collected, transferred to the laboratory for colony counting. **Results:** significant differences were found between the CFU/ml of oral bacteria from baseline saliva samples and after irrigating with magnetized water with different magnet strengths at $p \leq 0.005$. **Conclusion :** As the good antibacterial, fresh, cheap, and available; the regular use of magnetized water was suggested as the irrigant solution for good oral hygiene.

Key words: Magnetized water, Antibacterial, Irrigant

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INTRODUCTION

Magnetic water is based on science that started to invade many areas of the worlds, some consider it a magic description that

achieves many benefits at one time. In industry, it achieves a real fence of equipment and production lines against wear and tear and rapidly deteriorating salts. Magnetism is well known in the field of physics. Magnets prove to

be a strong safeguard against illness and serve as a highly beneficial preventive device. When water passes through the magnetic field, it undergoes certain changes. The magnetic field alters the electrical characteristics of hydrogen ions as well as minerals ⁽¹⁾. It is also known to draw pain out from the body, reduces stiffness of joints and muscles, and removes a toothache immediately. When water passes through the magnetic field, it undergoes certain changes. The magnetic field alters the electrical characteristics of hydrogen ions as well as minerals. The bio-south magnets help in reducing scale buildup. The bio-north magnetic water is used in the treatment of various diseases. The bio-south magnetic field stimulates the system ⁽²⁾

The force of magnetism influences the life of organisms. When a permanent magnet is kept in contact with water continuously for known time, the magnetic flux of magnet influences the water and becomes magnetized, also acquires magnetic properties. Best results are obtained if the water is used immediately after treatment ⁽³⁾. Its acceptability and long-term use as the mouth rinse by patients is associated with these side effects, more appropriate alternatives, especially for children, is needed. Thus, there has been a focus to find another natural alternative and cheap agents. These natural products have major advantages, that no side effect has been reported after their use ⁽⁴⁾

Scientists investigated the biological effect of a magnetic field by exposure three species of bacteria: *Streptococcus mutans*, *Staphylococcus aureus*, and *Escherichia coli* to ferrite magnets, and the results showed that the ferrite magnet field caused strength- dependent inhibition in growth rate and maximum decrease of bacterial numbers for *Staph aureus* and *Strept.mutans* especially under anaerobic conditions were obtained but was not inhibited under aerobic conditions ⁽⁵⁾. Magnetic water is a modernistic technology using magnetic devices which make vigorous concentration of magnetic field through the tube wall to deal with water and contribute with its properties. Treating water with magnetic forces (AMT or anti-scale magnetic treatment) is a controversial way believed to reduce the hard water effects by passing water through a magnetic field, which is a non-chemical method for water softening ⁽⁶⁾. The feasibility of Multi Drug Resistant (MDR) *P. aeruginosa* resistance Colistin which formed biofilm before using Magnetic water and after, were studied and observed that Colistin resistant *P. aeruginosa* had lost the ability to form the biofilm ⁽⁷⁾

The early studies conducted on the electromagnetism and their influence on organisms dates back on from the end of the nineteenth century, then concentrated on the following decades after the diffusion of telecommunication and global electrification. In contrast to the studies indicated above, the

research that investigates the field effects on microorganisms is very limited. For better understanding, well-characterized model microorganisms, with genetic markers, were used in medical -health research⁽⁸⁾. Calculus formed on the tooth surfaces is analogous to the formation of lime and scale deposits in water pipes. Magnetized water devices significantly reduce the scale deposits in the industry ; therefore, an oral irrigator with a magnetic water device may give a similar effect on the tooth calculus⁽⁹⁾. Since many types of researches have been done with the use of magnets in the medical field, its use in dentistry is still lacking.

MATERIALS AND METHODS

a- Magnetized Water sample preparation:

The tap water was magnetized by a locally made device at different magnetic strengths; where a Pyrex-type laboratory glass tube (12 cm in length and 13 mm in diameter) was taken and two magnetic pieces were installed on the outer diameter of the glass tube and it was of neodymium type. To prevent the tube from being broken and preserve the magnetic piece, the sides of this tube were covered with a locked casing designed for this as well ,perforating the middle of this cap to pass the sides of the glass tube through it and fix them by the handbag, and several devices were made with different magnetic strengths of 500,850, 1500, 1900 Gauss. The magnetic device was shown in (Figure 1).



Figure (1): The local made magnetic device

b-In Vivo study:

Saliva samples collection:

One hundred healthy persons of both sexes were included in this study, their ages ranged from 12-60 years, with no history of systemic diseases, and none of them were receiving

antimicrobial treatment at the time of the study. Those persons were divided into four groups according to the magnetic strength used:

- Group I: 500 Gauss (25 persons)
- Group II: 850 Gauss (25 persons)
- Group III: 1500 Gauss (25 persons)
- Group IV: 1900 Gauss (25 persons)

They were instructed not to eat or brush their teeth and not to rinse their mouths by mouth rinses at the morning of the experiment. The baseline saliva samples were collected from all groups with sterile vials, after that they were instructed to rinse their mouths by 10 milliliters of magnetized water samples for one minute, and the saliva samples after rinsing were collected into sterile vials. All vials were transferred to the laboratory immediately.

c-Microbiological method:

One milliliter of each sample (vial) was diluted decimally and then one milliliter of each dilution was cultured on Brain Heart Infusion agar plates (three replicates for each dilution), all petri dishes were incubated in 37 C⁰ for 24-48 hours, and the number of colonies was counted as CFU/ml⁽¹⁰⁾.

d-Statistical method:

The mean of the three replicates of the CFU/ml for saliva samples before and after rinsing with magnetized water was analyzed and compared using the SPSS program V.25. The means for groups between homogeneous subsets were displayed, compared by Wilcoxon Signed Rank Test. The differences were considered significant at $p \leq 0.005$.

RESULTS

After incubation, the bacterial cultures resulted from the baseline saliva specimens and the saliva samples after irrigation with the different magnetized water samples of different strengths were counted with aid of an 8X glass magnifier and colony-forming units per one milliliter (CFU/ml) were calculated. Cultures of samples before (A) and after rinsing (B) were shown in (Figure 2).

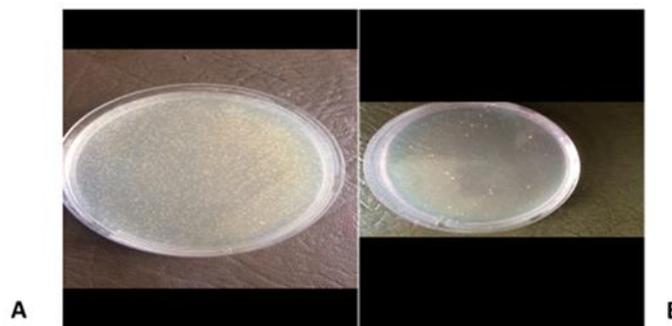


Figure (2): Effect of magnetic water with 500 Gauss magnet device on salivary bacterial count(A: before use, B: after use)

The number of colonies decreased in the samples of saliva after irrigation with magnetized water with all strengths, especially

with the 500, 850 and 1900 Gauss, as shown in (Tables 1, 2)

Table (1): ANOVA test explaining the significant difference between testing groups

count	Sum of squares	df	Mean square	F	Sig.
Between groups	140900.235	7	20128.605	4,971	.000
Within groups	777462.160	192	4049.282		
Total	918362.392	199			

Table (2): Duncan’s table of the effect of magnetic strengths on number of colonies in saliva (1,2,3...different subsets with significance*)

treatment	No.	Subsets for alpha =0.005			
500 G-before	25		2		
500 G-after	25	1*			
850 G-before	25			3	
850 G-after	25		2*		
1500 G-before	25		2		
1500 G-after	25		2		
1900 G-before	25				
1900 G-after	25		2*	3	

Table number one show us the significant effect of the magnetized water on the CFU/ml calculations after statistical analysis, especially the 500,1500,and 1900 Gauss magnetic strengths, also the effect is very clear in the histogram shown in (Figure 3)

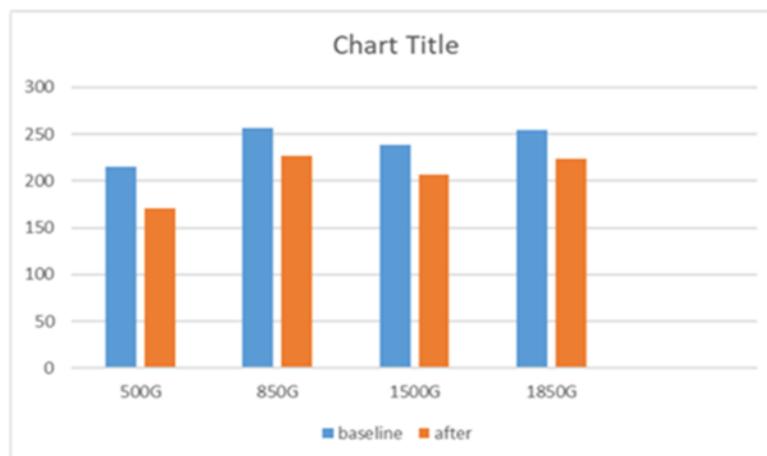


Figure (3):The effect of different magnetic strength on microbial counts
■ Before treatment
■ After treatment

DISCUSSION

Human body is composed of over 70% water. Circulation, absorption, digestion, and excretion depend on water that is required for blood, lymph, skin, and muscles. The pH of the human body is more acidic when we are sick. Magnetized water is alkaline, which raises our body pH, which allows the body to remove the toxins. Bio-magnetized water is energy - building, activating, and detoxifying^(2,11)

The relationship between magnetic power and water, what we understand from the old literature is that water - H₂O, with its bonds of hydrogen is related to each other, and these linkages may be bilateral or multiple. This may reach a large number of bonds, if we place water molecules within a magnetic field, these bonds between either atoms change or dissolve, and the dissociation absorb energy and reduces the water atoms union level, raising the ability of electrolysis and affecting the crystal dissolution.

Simply, water treatment with magnetic fields brings back the balance and natural energy that nature intended. Magnetized water has hydroxyl (OH⁻) ions much more than tap water, which makes it alkaline and reduces the acidity. Tap water has a pH of about 7. While magnetized water is alkaline, its pH is as high as 9.2. One benefit of the magnetic force is reducing the surface tension of the water, making it feel softer, wetter, thinner, and more

absorbable, and is able to penetrate cell walls carrying the nutrients⁽⁹⁾. Controversy regarding the impact effects of the magnetic field on water results from the physical structure of liquid water. Hydrogen micro clusters are formed when water is magnetized, these clusters react with oxygen molecules forming sodium hydroxide (NaOH), the water's pH is increased making it extra alkaline⁽¹³⁾

The oral irrigator using magnetized water could be a beneficial adjunct to prevent the accumulation of calculus in periodontal patients, but it has a minimal effect on plaque reduction. Also, there is clinical improvement in the gingival index, but no statistical significance found⁽¹⁴⁾. It is shown that treatment with magnetized water highly reduced the calculus accompanied or coexisted with caries⁽¹⁴⁾. Magnetized water prevents the bonding process between the plaque and the teeth by "magneto-hydro-dynamics", which prevents naturally occurring mineral deposits in fluids⁽⁴⁾

CONCLUSIONS

It is important to develop the knowledge of treatment with magnetized water, the target where we can predict the effects of magnetic treatment reliably and proven to be economically attractive.

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