

Clinicopathological Effects of Magnetic Water and Yeast Supplementation (*Saccharomyces cerevisiae*) on Broilers

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Abstract

This study was conducted on 40 one-day-old broiler chicks for five weeks to investigate the influence of magnetic water and yeast supplementation (*Saccharomyces cerevisiae*) on growth performance, haematological parameters, some serum biochemical parameters, oxidative stress and antioxidant, as well as some inflammatory markers. The chicks were divided into four equal groups, as follows: G I: free from water additives, G II: supplied with magnetic water, G III: supplied with yeast as water additives in dose 0.8g/L daily and G IV: supplied with combination of magnetic water and yeast in dose 0.8 g/L daily. Our findings revealed that body weight and weight gain did not differ significantly among different groups. The magnetic and yeast groups had significantly lower feed intake and feed conversion ratios, while the combination group had no obvious variation in feed intake matched to the control one. The RBCs count, Hb, PCV, MCV, MCH, and MCHC levels did not differ significantly among different groups. The WBCs count increased significantly in the magnetic water and yeast groups, however there was no marked difference in the combination group. ALT reduced significantly in magnetic water, whereas AST did not change significantly in any of the groups. Total proteins, albumin, globulin, glucose, uric acid and creatinine levels did not differ significantly across all groups. Malondialdehyde and GSH showed no statistically significant difference in magnetic water, yeast group, or combination group. IL6 levels increased significantly in the magnetic water and yeast groups, but not in the combination group. IL10 concentrations were markedly lower in the magnetic water and yeast groups, but not in the combination group. It is possible to conclude that using magnetic water and yeast improved growth performance while having no toxic effect in broiler chicken.

Key words: Broilers, magnetic water, *Saccharomyces cerevisiae*, oxidative stress, growth performance.

Introduction

Global poultry production has been rapidly increasing (*Singh et al., 2019*). Poultry meat is distinguished by its high quality, high level of safety, low prices in comparison to other meat types, and short production cycles (*Wahyono and Utami, 2018*). A rising request for poultry meat has been resulted in increased production volume, as well as increased exports and imports (*Kozioł and Krzywoń, 2014*).

Water is one of the most significant nutrients in animal nutrition, additionally it plays a vital physiological role in bird and other animal thermal homeostasis, predominantly during heat stress (*Bruno et al., 2011*). Magnetized water is water that has been exposed to a stable magnetic field, causing the separation of positive and negative particles and the formation of a new structure (*Coey and Cass, 2000*). Magnetic water is likely effective in cell growth by increasing mineral solubility and oxygen concentration, as well as accelerating the transmission of water and nutrients through the body by improving cell wall permeability as a result of reduced surface tension and electric conductivity (*El-Hamid et al., 2018*).

Recently, there has been a strong push to reduce or eliminate the use of antibiotics in the poultry and animal feed, in addition to an increase in customer worry about poultry medicine residues in meat

then eggs (*Shankar et al., 2018*). Moreover, the usage of prebiotics, probiotics, as well as organic acids in place of antibiotics has recently enlarged. Probiotics decrease gut pH, generate bacteriocins, peroxides, and lysozyme, and boost the immune system through competitive exclusion (*Grashorn, 2010*). *Saccharomyces cerevisiae* (SC), as well recognized as "baker's yeast" is a commonly commercialized kind of yeast that has been fed to animals for long time (*Rezaei-pour et al., 2012*). Yeast (SC) is high in protein, trace minerals, and vitamin B complex, as well as many other nutrients (*Gao et al., 2008*).

The goal of this research was to look into the effect of magnetic water, yeast supplementation and combination of both on blood picture, serum biochemical parameters, oxidative and antioxidant status, as well as inflammatory markers in broiler chicken.

Materials and Methods

Chemicals

BioMed Co. (Egypt) provided the kits used to measure AST, ALT, total proteins, albumin, glucose, creatinine, uric acid, MDA, and GSH. However, the chicken interleukin 6 (IL-6) besides interleukin (IL-10) were obtained from My BioSource Co. (USA).

Magnetic water

The water was magnetized using a liquid magnetic reactor provided by Nefertari Biomagnetic

(www.magnetic.nefertari2.com).

Every day, from the first to the last, broilers were allowed unrestricted access to magnetic water.

Yeast

Dried yeast (*Saccharomyces cerevisiae*) was obtained from Akamaya Pazarlama A.S. (Turkey).

Experimental plan

Forty Indian River (IR) one-day old chicks were obtained from Teba Co., Egypt. The chicks were housed in floor pens that were littered with unused wood shavings, with unlimited access to the well-adjusted commercial basal ration and water till the experiment ended. Temperature was adjusted based on age, starting at 32°C and decreasing by 2°C per week until reaching the final temperature. The chicks were haphazardly separated into four equivalent groups. Group (1) was nourished on a standard diet and drank tap water without supplementation and served as the control group. Group (2) was given magnetic water. Group (3) received dried yeast as water additive in dose 0.8 g/L daily (*Onwurah et al., 2013*). Group (4) received both magnetic water and yeast as group 2, 3. The ingredient composition and chemical analysis of the basal diet used in the experiment are presented in tables 1.

Vaccination:

All chicken was vaccinated by oral route as recommended by Veterinary medicine directorate according to the following vaccination schedule:

1- IZOVAC B1 HITCHENER (freeze -dried live vaccine against Newcastle disease) at the 7TH day old.

2- PESTICAL ®LA SOTA SPF (freeze -dried live, attenuated vaccine against Newcastle diseases) La Sota strain, at the 12th day old.

3- GUMBOKAL ® IM SPF (freeze -dried live, attenuated vaccine against Gumboro disease virus) at the 18th day old.

Blood sampling

At the end of the third and fifth weeks, 5 birds from each group were collected at random and blood was taken from the wing vein. Every single blood sample was divided into two portions. The first part was collected in EDTA containing tubes for haematological examination. The second part was collected in plain tubes and then centrifuged at 3000 rpm for 10 minutes. Finally, serum samples were carefully separated, collected, and kept at -20 °C for the analysis of biochemical parameters.

Growth performance

At the start of the experiment, the body weight of each bird was documented. Body weight, weight gain, and feed intake for each group were tracked weekly. The feed conversion ratio (FCR) was calculated (*Nobo et al., 2012*).

Hematological measurements

Whole blood was used for assessment of hematological parameters. The Neubauer hemocytometer was used to perform total erythrocytic and total

leukocytic counts using the Natt and Herrick's solution as reported by *Natt and Herrick (1952)*. Packed cell volume (PCV) was determined as described by *Coles (1986)*. The hemoglobin concentration was estimated by the cyanomet-hemoglobin colorimetric way, as mentioned by *Zijlstra (1960)*. The erythrocytic indices (MCV, MCH, and MCHC) were calculated according to *Coles (1986)*. The differential leukocytic count was performed as described by *Feldman et al. (2000)*.

Biochemical assessment, Redox state and Interleukin analysis

Serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were determined as described by *Reitman and Frankel (1957)*. Total protein and albumin concentrations were measured as reported by *Kingsley (1939)* and *Rodkey (1965)* respectively. Glucose was estimated

according to *Trinder (1969b)*. Uric acid and creatinine were measured as reported previously (*Trinder, 1969a; Henry et al., 1967*).

Serum MDA level was measured according to *Ohkawa et al. (1979)*. The level of serum GSH was assayed as mentioned by *Beutler et al. (1963)*.

Serum IL-6 and IL-10 concentrations were measured by the enzyme-linked immunosorbent assay (ELISA) as described by *Febbraio et al. (2004)* and *Bastard et al. (1994)* correspondingly.

Statistical analysis

To collect data and achieve a one-way analysis of variance, the SPSS software package version 20.0 was used. The means were then compared using the Duncan multiple comparison test. $P \leq 0.05$ was regarded as a significant level. The findings were offered as means \pm standard errors (*Landau and Everitt, 2003*).

Table (1): Composition of chicken's standard basal ration

Ingredients	Starter (0-3 weeks)	Finisher ration (4-5 weeks)
Ground Yellow corn	55.8	67.97
Soya beans meal	38.0	26.0
Corn gluten meal (60%)	2.0	2.0
Soya bean oil	0.5	0.5
Dicalcium phosphate	1.41	0.84
Limestone	1.26	1.69
Salt	0.3	0.3
*Vitamins ,minerals premix	0.5	0.5
D L - methionine	0.1	0.1
L-lysine	0.1	0.1
Calculated composition	100	100
Crude protein	23.0	19.0
ME Kcal per kg	3000	2100
Raw fat	3.38	5.41
Raw fiber	3.39	3.50

*premix: (1%) provided the following (per kg of complete diets), 1400 IU Vit. A , 3000 IU VitD3, 50mg Vit.E ,4 mg Vit.k, 3mg Vit.B6, 6mg Vit.B12, 60mg niacin, 20 mg pantothenic acid , 0.2 mg folic acid, 150 mg choline, 4.8 mg Ca, 3.18 mg P, 100 mg Mn, 50 mg Fe ,80 mg Zn, 10 mg Cu, 0.25 mg Co , 1.5 mg Iodine.

Results

Growth performance

Table (2) demonstrated the effect of various treatments on growth performance parameters during the third and fifth weeks of the experiment. Body weight and weight gain did not show significant difference among groups by the third week when compared to the control one. On the other hand, feed intake and FCR decreased significantly in the magnetic and yeast groups but not in the combination group when compared to the control. Body weight and weight gain did not show significant variations among groups by the fifth week when compared to the control. While feed intake and FCR were significantly lower in all groups when compared to the control one.

Hematology

Table (3) showed the influence of different treatments on erythrogram during the third and fifth weeks of the experiment. RBC count, Hb concentration, PCV, MCV, MCH, MCHC did not differ significantly between groups on the third and fifth weeks when compared to the control. Table (4) revealed the influence of different treatments on leukogram during the third and fifth weeks of the experiment. After 3 weeks, the total white blood cells, heterophil and monocyte count significantly increased in the magnetic water and yeast groups compared with control group, but it didn't show any significant difference in combination group compared with

control. Lymphocytes and eosinophils count significantly increased in magnetic water group in comparison with control group; but there was a non-significant change in yeast group and combination group compared with control group. Basophil count revealed non-significant change in all groups compared with control group. After 5 weeks, the total white blood cells, heterophil, lymphocytes, monocytes, eosinophils and basophils count didn't show any significant difference among different groups compared with control group.

Serum biochemistry

Table (5) exhibited the effect of various treatments on serum biochemical parameters during the third and fifth weeks of the experiment. On the third week, ALT and AST activities, glucose, total protein, albumin, globulin, A/G ratio, uric acid, and creatinine levels did not differ significantly between groups when compared to the control. On the fifth week, ALT activity decreased significantly in the magnetic group but did not change significantly in the yeast or combination groups when compared to the control group. AST activity, glucose, total protein, albumin, globulin, A/G ratio, uric acid, and creatinine levels, on the other hand, did not differ significantly between groups when compared to the control.

Redox state

Table (6) demonstrated the effect of various treatments on oxidant and

antioxidant parameters during the third and fifth weeks of the experiment. MDA and GSH levels did not differ significantly between groups on the third and fifth weeks.

Interleukins

Table (6) revealed the effect of various treatments on some interleukins during the third and fifth weeks of the experiment. On the third week, IL-6 concentrations were markedly elevated in the magnetic and yeast groups but not in the combination group when compared to the control. However,

IL-10 levels were markedly lower in the magnetic and yeast groups but not in the combination group when compared to the control. On the fifth week, IL-6 did not change significantly in the magnetic group, increased significantly in the yeast group, and decreased significantly in the combination group compared to the control. IL-10, on the other hand, had no effect on the magnetic or combination groups and revealed a marked reduction in the yeast group when compared to the control.

Table (2): The effect of different treatments after three and five weeks on the growth performance in broilers.

Parameters	Experimental groups							
	3 weeks				5 weeks			
	Control	Magnetic	Yeast	Combination	Control	Magnetic	Yeast	Combination
Body weight (g)	750.83 ^a ± 22.20	721.13 ^a ± 28.15	710.17 ^a ± 21.84	713.33 ^a ± 22.82	1939.35 ^a ± 54.09	1839.35 ^a ± 62.88	1796.11 ^a ± 68.76	1790.19 ^a ± 68.81
Weight gain	660.13 ^a ± 16.95	697.83 ^a ± 23.49	671.66 ^a ± 19.99	696.42 ^a ± 18.66	1847.46 ^a ± 42.96	1870.04 ^a ± 46.72	1843.94 ^a ± 43.04	1958.91 ^a ± 40.37
Feed intake (g)	822.21 ^a ± 2.01	723.72 ^b ± 3.53	648.82 ^c ± 1.89	824.78 ^a ± 1.80	2599.73 ^a ± 2.75	2380.44 ^d ± 2.98	2478.45 ^c ± 3.01	2513.25 ^b ± 3.75
FCR	1.25 ^a ± 0.027	1.04 ^b ± 0.027	0.96 ^b ± 0.02	1.19 ^a ± 0.02	1.41 ^a ± 0.01	1.27 ^c ± 0.01	1.34 ^b ± 0.01	1.28 ^c ± 0.01

Data are expressed as mean ± S.E (n=5).

Mean values within the same column having different superscript letters are significant at (p<0.05).

Table (3): The effect of different treatments after three and five weeks on some erythrogram in broiler.

Parameters	Experimental groups							
	3 weeks				5 weeks			
	Control	Magnetic	Yeast	Combination	Control	Magnetic	Yeast	Combination
WBCs (x10 ³ /µl)	52.00 ^b ± 6.11	82.00 ^a ± 5.77	80.67 ^a ± 3.33	58.67 ^b ± 6.77	35.33 ^{ab} ± 3.53	37.33 ^a ± 5.46	27.33 ^{ab} ± 2.91	24.00 ^b ± 2.0
Heterophils (x10 ³ /µl)	16.48 ^c ± 2.78	27.30 ^{ab} ± 1.70	29.39 ^a ± 2.24	22.04 ^{bc} ± 1.44	20.65 ^{ab} ± 1.85	23.09 ^a ± 3.64	15.65 ^{ab} ± 1.62	15.01 ^b ± 1.13
Lymphocytes (x10 ³ /µl)	30.39 ^b ± 3.06	44.75 ^a ± 4.54	41.70 ^{ab} ± 2.20	30.70 ^b ± 4.47	11.61 ^a ± 1.65	10.78 ^a ± 1.40	9.06 ^a ± 1.14	7.17 ^a ± 0.92
Monocytes (x10 ³ /µl)	3.28 ^b ± 0.35	6.49 ^a ± 0.04	6.67 ^a ± 0.44	4.00 ^b ± 0.88	2.01 ^{ab} ± 0.26	2.76 ^a ± 0.55	1.81 ^{ab} ± 0.13	1.20 ^b ± 0.16
Eosinophils (x10 ³ /µl)	1.71 ^b ± 0.14	2.94 ^a ± 0.34	2.39 ^{ab} ± 0.38	1.69 ^b ± 0.17	0.96 ^a ± 0.19	0.70 ^a ± 0.16	0.65 ^a ± 0.16	0.63 ^a ± 0.13
Basophils (x10 ³ /µl)	0.15 ^a ± 0.15	0.51 ^a ± 0.26	0.53 ^a ± 0.26	0.24 ^a ± 0.24	0.10 ^a ± 0.10	0.00 ^a ± 0.00	0.17 ^a ± 0.09	0.00 ^a ± 0.00

Data are expressed as mean ± S.E (n=5).

Mean values within the same column having different superscript letters are significant at (p<0.05).

Table (4): The effect of different treatments after three and five weeks on leukogram in broilers.

Parameters	Experimental groups							
	3 weeks				5 weeks			
	Control	Magnetic	Yeast	Combination	Control	Magnetic	Yeast	Combination
RBCs (×106/ μ l)	2.38 ^a ±0.13	2.34 ^a ±0.17	2.20 ^a ±0.07	2.38 ^a ±0.16	2.59 ^a ±0.16	2.21 ^a ±0.01	2.24 ^a ±0.03	2.53 ^a ± 0.18
Hb (g/dl)	6.21 ^a ±0.26	6.15 ^a ±0.24	6.25 ^a ±0.42	5.90 ^a ±0.13	7.03 ^a ±0.14	7.23 ^a ±0.15	7.28 ^a ±0.06	7.39 ^a ±0.11
PCV (%)	26.20 ^a ±0.37	23.80 ^a ±0.37	26.00 ^a ±1.04	24.60 ^a ±0.51	28.80 ^a ±1.32	30.20 ^a ±0.97	31.00 ^a ±2.10	32.00 ^a ±2.47
MCV (fl)	110.98 ^a ±4.87	101.71 ^a ±8.22	118.18 ^a ±8.26	103.36 ^a ± 7.41	112.91 ^a ±8.59	136.54 ^a ±4.48	138.39 ^a ±10.83	128.85 ^a ±12.32
MCH (pg)	26.09 ^a ±1.57	26.28 ^a ±2.51	28.41 ^a ±2.70	24.79 ^a ±1.70	27.70 ^a ±2.36	32.66 ^a ±0.56	32.50 ^a ±0.56	29.97 ^a ±2.83
MCHC (%)	23.70 ^a ±0.82	25.83 ^a ±0.77	24.04 ^a ±0.74	23.98 ^a ±0.40	24.57 ^a ±0.93	24.0 ^a ±0.74	23.48 ^a ±1.46	23.58 ^a ±1.63

Data are expressed as mean± S.E (n=5).

Mean values within the same column having different superscript letters are significant at (p<0.05).

Table (5): The effect of different treatments after three and five weeks on serum biochemical parameters in broilers.

Parameters	Experimental groups							
	3 weeks				5 weeks			
	Control	Magnetic	Yeast	Combination	Control	Magnetic	Yeast	Combination
ALT (U/L)	18.68 ^a ±1.73	18.64 ^a ±1.28	18.66 ^a ±0.41	19.02 ^a ±1.80	31.12 ^a ±1.36	23.64 ^b ±1.66	27.26 ^{ab} ±1.03	30.16 ^a ±2.09
AST (U/L)	20.12 ^a ±1.66	24.08 ^a ±0.54	22.58 ^a ±1.52	22.82 ^a ±1.11	18.25 ^a ±1.58	21.37 ^a ±1.06	21.45 ^a ±1.50	22.15 ^a ±1.30
T. protein (g/dl)	6.68 ^a ±0.16	6.67 ^a ±0.15	6.88 ^a ±0.20	6.85 ^a ± 0.16	7.05 ^a ±0.25	6.61 ^a ±0.13	6.57 ^a ±0.13	6.72 ^a ± 0.18
Albumin (g/dl)	3.88 ^a ±0.21	3.80 ^a ±0.07	4.07 ^a ±0.19	3.87 ^a ± 0.19	4.57 ^a ±0.06	4.45 ^a ±0.09	4.52 ^a ±0.12	4.36 ^a ± 0.12
Globulin (g/dl)	3.04 ^a ±0.12	2.87 ^a ±0.16	2.97 ^a ±0.32	2.98 ^a ±0.10	2.48 ^a ±0.25	2.16 ^a ±0.14	2.04 ^a ±0.04	2.37 ^a ± 0.07
A/G ratio	1.26 ^a ±0.13	1.34 ^a ±0.09	1.35 ^a ±0.10	1.31 ^a ±0.09	1.90 ^a ±0.17	2.10 ^a ±0.16	2.22 ^a ±0.06	1.84 ^a ±0.02
Glucose (mg/dl)	300.67 ^a ±3.18	303.67 ^a ±3.18	303.67 ^a ±3.48	291.67 ^a ± 4.06	287.33 ^a ±2.73	288.0 ^a ±4.04	279.67 ^a ±2.91	280.33 ^a ±4.98
Uric acid (mg/dl)	6.18 ^a ±0.09	6.67 ^a ±0.25	6.29 ^a ±0.17	6.72 ^a ± 0.15	6.33 ^a ±0.14	6.40 ^a ±0.07	6.35 ^a ±0.18	6.07 ^a ±0.08
Creatinine (mg/dl)	1.05 ^a ± 0.10	0.88 ^a ±0.05	0.90 ^a ±0.03	0.97 ^a ± 0.06	1.16 ^a ±0.12	1.14 ^a ±0.10	1.12 ^a ±0.09	0.98 ^a ±0.12

Data are expressed as mean± S.E (n=5).

Mean values within the same column having different superscript letters are significant at (p<0.05).

Table (6): The effect of different treatments after three and five weeks on MDA, GSH and interleukins in broilers.

Parameters	Experimental groups							
	3 weeks				5 weeks			
	Control	Magnetic	Yeast	Combination	Control	Magnetic	Yeast	Combination
MDA (nmol/ml)	9.92 ^a ± 0.20	9.80 ^a ± 0.20	9.65 ^a ± 0.22	9.98 ^a ± 0.06	9.71 ^{ab} ± 0.07	10.09 ^a ± 0.05	9.64 ^b ± 0.20	9.92 ^{ab} ± 0.16
GSH (mmol/L)	2.82 ^a ± 0.09	2.70 ^a ± 0.08	2.74 ^a ± 0.12	2.59 ^a ± 0.10	2.28 ^a ± 0.09	2.21 ^a ± 0.09	2.23 ^a ± 0.12	2.34 ^a ± 0.09
IL6 (pg/ml)	133.50 ^c ± 2.02	390 ^a ± 28.87	205 ^b ± 5.77	121 ^c ± 12.12	330 ^b ± 28.87	342.50 ^{ab} ± 15.88	400 ^a ± 5.77	252.50 ^c ± 12.99
IL10 (pg/ml)	8.83 ^a ± 0.55	2.38 ^c ± 0.07	7.62 ^b ± 0.22	9.20 ^a ± 0.12	2.41 ^a ± 0.40	2.45 ^a ± 0.09	1.38 ^b ± 0.07	2.38 ^a ± 0.22

Data are expressed as mean ± S.E (n=5).

Mean values within the same column having different superscript letters are significant at (p<0.05).

Discussion

The body weight gain revealed numerical increase in the magnetic group compared to the control. These results were consistent with a previous study that found magnetic water had no effect on body weight gain (Mitre, 2018). Another study found that birds treated with magnetized water for a longer period of time showed nonsignificant higher weight gain than the control group (Alhassani and Amin, 2012). Weight gain in the yeast group was not significantly different. A previous study found that yeast-derived products had no obvious effect on body weight gain, implying that these products under non-challenged conditions have no powerful growth-promoting effect. However, under pathogen challenge conditions, yeast-derived products may be more beneficial (Alizadeh et al., 2016b). In terms of feed intake, there were significant decreases in the magnetic water supplemented

group compared to the control. These results were constant with earlier research that found that feed intake in the control group was slightly higher than in the magnetic water-supplemented group (SagBaug, 2003). Feed intake was markedly reduced in the yeast group compared to the control one. Our results are in line with those of Santin et al. (2006) who found that adding yeast to broiler diets significantly reduced feed intake. FCR was significantly lower in the magnetic group compared to the control group. Our results were in agreement with those of El-Katcha et al. (2017), who observed improved feed conversion in Pekin ducklings and this was attributed to magnetic water's power to lengthen intestinal villi, thereby nutrient absorption was improved. Similarly, when compared to the control, the yeast group had a marked decrease in FCR. This could be due to improved intestinal morphology and

cell proliferation as measured by increased villi density and height, which may result in improved feed utilization (*Lawrence-Azua et al., 2018*). Furthermore, the special effects of these products on gut improvement and the elimination of pathogenic bacteria such as Salmonella and E. coli could explain it (*Ghosh et al., 2012*). Also, early colonization of beneficial yeast may have played a critical role in the establishment of a favorable microbial environment in the gut, resulting in better feed utilization and nutrient absorption (*Shankar et al., 2017*).

The erythrocytic parameters revealed no significant differences in the magnetic group. *Jassim and Aqeel (2017)* reported that magnetic water drinking did not result in significant differences in RBCs count, Hb concentration, or PCV values in broiler chickens. Changes in these blood parameters may occur as a result of conditions such as infection or poor health, whereas the experiment due to a change in nutritional circumstances did not reveal significant variations (*Jassim and Aqeel, 2017*). These parameters did not reveal significant difference between the yeast and control groups. Our findings agreed with those of *Al-Mansour et al. (2011)* who found no significant differences in RBCs count, Hb concentration, HCT, MCV, or MCH in chicks fed yeast supplemented diets. When total and differential leukocytic counts of magnetic water and yeast

supplemented chickens were compared after three weeks, the magnetic group showed significant increases in total and differential leukocytic counts compared to the control group. This finding was in agreement with *El-Katcha et al. (2018)* who reported that magnetic water can increase WBCs. Also, there was a marked elevation in WBCs count in the yeast supplemented group when compared to the control group, which agreed with *Ahmed et al. (2015)*.

The ALT and AST activities in the magnetic group did not change significantly from those in the control group, indicating that drinking magnetic water does not harm hepatocytes (*Mustafa and Hassani, 2008*). Our findings agreed with those of *Al-Hilali (2018)*, who found that liver enzymes in Japanese quail drinking magnetized water remained unchanged. When compared to the control group, the yeast group did not reveal marked differences in hepatic enzyme activities. Our results were in line with those of *Nath et al. (2016)*, who reported that chickens supplemented with yeast had lower ALT and stable AST activities than controls, possibly due to the yeast probiotic's hepatoprotective effect. Uric acid and creatinine concentrations did not change significantly between the treated and control groups, indicating that magnetic water and yeast have no negative effects on kidney function.

Broiler chickens supplemented with magnetic water and yeast group showed nonsignificant changes in serum glucose level compared with control group. This result was in accordance with *Jassim and Aqeel (2017)*, who reported that there were no changes in glucose in broilers when using magnetic water and also, agreed with *Lawrence-Azua et al. (2018)*, who reported there was no-significance changed in glucose level in broiler after supplemented with different treatments of yeast (1.5, 2.0, 2.5 and 3.0%).

Concerning to the serum level of MDA, there were non-significant decreases in MDA level after magnetic water and yeast supplementation to broiler chickens compared with control group. This result agreed with *Shah and Nagarajan (2013)*, and *Hafizi et al. (2014)* for magnetic water and agreed with *Li et al. (2016)* and *Li et al. (2017)*, who reported that it did not show any significant change in yeast group on broilers.

The current study found that IL-6 level increased significantly in the magnetic water group compared to the control group in the third week. Our result agreed with *Donohue (2003)*. Similarly, the yeast group revealed a marked elevation in IL-6 when compared to the control, which was consistent with *Kumar et al. (2019)* findings. Live yeast could modulate immune responses by increasing the inflammatory

cytokines expression like IL-1, IL-2, and IL-6 (*Alizadeh et al., 2016b; Generoso et al., 2011*). It has been proposed that -glucan derived from yeast cell wall is effective at priming and activating inflammatory responses (*Tzianabos, 2000*). At the fifth week, IL-6 concentrations in all groups increased significantly, possibly due to heat stress. Stress, in the form of elevated corticosterone levels, causes the upregulation of pro-inflammatory chemokines. It also significantly increases the pro-inflammatory cytokine IL-6 levels (*Nidamanuri et al., 2017*). However, IL-10 revealed a marked reduction in the yeast group compared to the control one. It was reported that under normal health conditions, supplementing diets with yeast-derived products reduced cytokine expression in broiler chickens. (*Alizadeh et al., 2016a*). The differences in yeast immunomodulatory properties may be due to the different experimental circumstances used in these studies, implying a role for these products in regulating immune homeostasis and the fact that yeast cell walls may display different immunomodulatory effects in challenged versus non-challenged conditions. (*Alizadeh et al., 2016b*).

Conclusion

Finally, the current study demonstrated that using magnetic water or yeast supplementation alone in broilers improved growth performance by lowering feed

intake and feed conversion ratio. They also have no toxic effects on the liver or kidney. Further studies are needed for using the magnetic water for broilers with stronger magnetic field.

References

- Ahmed, M. E., Abbas, T. E., Abdhag, M. A. & Mukhtar, D. E. (2015).** Effect of dietary yeast (*Saccharomyces cerevisiae*) supplementation on performance, carcass characteristics and some metabolic responses of broilers. *J Animal Veterinary Sciences*, 3(5-1), 5-10.
- Al-Hilali, A. (2018).** Effect of magnetically treated water on physiological and biochemical blood parameters of Japanese quail. *J Int. J. Poult. Sci*, 17(2), 78-84.
- Al-Mansour, S., Al-Khalf, A., Al-Homidan, I. & Fathi, M. (2011).** Feed efficiency and blood hematology of broiler chicks given a diet supplemented with yeast culture. *J Int. J. Poult. Sci*, 10(8), 603-607.
- Alhassani, D. & Amin, G. (2012).** Response of some productive traits of broiler chickens to magnetic water. *J International Journal of Poultry Science*, 11(2), 158-160.
- Alizadeh, M., Rodriguez-Lecompte, J., Rogiewicz, A., Patterson, R. & Slominski, B. (2016a).** Effect of yeast-derived products and distillers dried grains with solubles (DDGS) on growth performance, gut morphology, and gene expression of pattern recognition receptors and cytokines in broiler chickens. *J Poultry science*, 95(3), 507-517.
- Alizadeh, M., Rodriguez-Lecompte, J., Yitbarek, A., Sharif, S., Crow, G. & Slominski, B. (2016b).** Effect of yeast-derived products on systemic innate immune response of broiler chickens following a lipopolysaccharide challenge. *J Poultry science*, 95(10), 2266-2273.
- Bastard, C., Deweindt, C., Kerckaert, J. P., Lenormand, B., Rossi, A., Pezzella, F., et al. (1994).** LAZ3 rearrangements in non-Hodgkin's lymphoma: correlation with histology, immunophenotype, karyotype, and clinical outcome in 217 patients. *Blood*, 83(9), 2423-2427.
- Beutler, E., Duron, O. & Kelly, B. M. (1963).** Improved method for the determination of blood glutathione. *Journal of Laboratory and Clinical Medicine*, 61, 882-888.
- Bruno, L., Maiorka, A., Macari, M., Furlan, R. L. & Givisiez, P. (2011).** Water intake behavior of broiler chickens exposed to heat stress and drinking from bell or and nipple drinkers. *J Brazilian Journal of Poultry Science*, 13, 147-152.
- Coey, J. & Cass, S. (2000).** Magnetic water treatment. *J Journal of Magnetism Magnetic materials*, 209(1-3), 71-74.

- Coles, E. J. L., Toronto, Mexico City Rio De Janeiro, Sydney, Tokyo Hong Kong. (1986).** *Veterinary Clinical Pathology.* Published by WB Saunders Company Philadelphia. 1-486.
- Donohue, P. G. 2003.** Can you drink too much water? *Winona Daily News.*
- El-Hamid, A., El-Speiy, M., Hassan, S. & Habbibe, M. (2018).** Performance, immunity response, blood biochemical and hematological traits of growing male rabbits affected by type water with zinc. *J Egyptian Journal of Rabbit Science*, 28(1), 129-155.
- El-Katcha, M., Soltan, M. A., El-Shobokshy, S. A. & Kasser, M. J. a. J. F. V. S. (2018).** Impact of Water Acidification or Magnetic Treatment on Growth Performance, Health and Oxidative Status of Broiler Chicks Challenged by Salmonella Enteritidis. *59(2).*
- El-Katcha, M. I., Soltan, M. A., El Naggari, K. & Farfour, H. T. (2017).** Effect of Magnetic Water Treatment and Some Additives on Growth Performance, Some Blood Biochemical Parameters and Intestinal Health of Growing Pekin Ducklings. *J Alexandria Journal for Veterinary Sciences*, 53(1).
- Febbraio, M. A., Hiscock, N., Sacchetti, M., Fischer, C. P. & Pedersen, B. K. (2004).** Interleukin-6 is a novel factor mediating glucose homeostasis during skeletal muscle contraction. *J Clinical Chemistry*, 53(7), 1643-1648.
- Feldman, B. F., Zinkl, J. G. & Jain, N. C. 2000.** *Schalm's Veterinary Hematology.*, Lippincott Williams & Wilkins,.
- Gao, J., Zhang, H., Yu, S., Wu, S., Yoon, I., Quigley, J., et al. (2008).** Effects of yeast culture in broiler diets on performance and immunomodulatory functions. *J Poultry science*, 87(7), 1377-1384.
- Generoso, S. V., Viana, M. L., Santos, R. G., Arantes, R. M., Martins, F. S., Nicoli, J. R., et al. (2011).** Protection against increased intestinal permeability and bacterial translocation induced by intestinal obstruction in mice treated with viable and heat-killed *Saccharomyces boulardii*. *J European journal of nutrition*, 50(4), 261-269.
- Ghosh, T., Haldar, S., Bedford, M., Muthusami, N., Samanta, I. & Nutrition, A. (2012).** Assessment of yeast cell wall as replacements for antibiotic growth promoters in broiler diets: effects on performance, intestinal histo-morphology and humoral immune responses. *J Journal of Animal Physiology*, 96(2), 275-284.
- Grashorn, M. (2010).** Use of phytobiotics in broiler nutrition—an alternative to infeed antibiotics. *J J. Anim. Feed Sci*, 19(3), 338-347.
- Hafizi, L., Gholizadeh, M., Karimi, M., Hosseini, G., Mostafavi-**

- Toroghi, H., Haddadi, M., et al. (2014).** Effects of magnetized water on ovary, pre-implantation stage endometrial and fallopian tube epithelial cells in mice. %*J Iranian Journal of Reproductive Medicine*, 12(4), 243.
- Henry, R., Principles & Technique. (1967).** Determination of creatine and creatinine. *J Clinical Chemistry*, 292-296.
- Jassim, E. & Aqeel, C. H. (2017).** Effect of alkaline water and/or magnetic water on some physiological characteristic in broiler chicken. *J. Entomol. Zool. Stud*, 5(5), 1643-1647.
- Kingsley, G. R. (1939).** The determination of serum total protein, albumin, and globulin by the biuret reaction. *J Journal of Biological Chemistry*, 131(1), 197-200.
- Kozioł, I. & Krzywoń, M. (2014).** The condition of the poultry industry in Poland. *J Prog Eco Sci*, 1, 85-98.
- Kumar, S., Yadav, S., Chandra, G., Sahu, D., Kumar, R., Maurya, P. S., et al. (2019).** Effect of dietary supplementation of yeast (*Saccharomyces cerevisiae*) on performance and hemato-biochemical status of broilers. *Indian Journal of Poultry Science*, 54 (1).
- Lawrence-Azua, O., Awe, A., Saka, A., Okotie, U., Awodele, O. & Isegbe, E. (2018).** Effect of yeast (*Saccharomyces cerevisiae*) supplementation on the growth performance, haematological and serum biochemical parameters of broiler chicken. *J Nigerian Journal of Animal Science*, 20(1), 191-199.
- Li, X., Chen, Y., Cheng, Y., Wen, C. & Zhou, Y. (2017).** Effects of dietary supplementation with yeast cell wall, palygorskite and their combination on the growth performance, meat quality, muscular antioxidant ability and mineral element content of broilers. *J European Poultry Science*, 81.
- Li, X., Chen, Y., Cheng, Y., Yang, W., Wen, C. & Zhou, Y. (2016).** Effect of yeast cell wall powder with different particle sizes on the growth performance, serum metabolites, immunity and oxidative status of broilers. *J Animal Feed Science Technology*, 212, 81-89.
- Mitre, K. (2018).** The effect of magnetic water on feed conversion ratio, body weight gain, feed intake and livability of male broiler chickens.
- Mustafa, M. & Hassani, D. (2008).** Effects of magnetization of water on production traits and egg quality of broiler breeders (Cobb-500) during the summer season. *J Iraq. J. Poult. Sci*, 3(2), 71-81.
- Nath, B. K., Hossain, M. A., Saiful Bari, M., Barua, M., Islam, K. & Chanda, G. C. (2016).** Growth performance and serum biochemical responses of commercial broilers fed diets containing rubber seed and

yeast. *J Asian Journal of Poultry Science*, 10(2), 96-103.

Natt, M. P. & Herrick, C. A. (1952). A new blood diluent for counting the erythrocytes and leucocytes of the chicken. *J Poultry science*, 31(4), 735-738.

Nidamanuri, A. L., Murugesan, S. & Mahapatra, R. K. (2017). Effect of heat stress on physiological parameters of layers-a review. *International Journal of Livestock Research, Volume 7 (4)*, 1-17.

Nobo, G., Moreki, J. C. & Nsoso, S. J. (2012). Growth and carcass characteristics of helmeted guinea fowl (*Numida meleagris*) fed varying levels of Phane meal (*Imbrasia belina*) as replacement of fishmeal under intensive system. *J Int. J. Agro Vet. Med. Sci*, 6(4), 296-306.

Ohkawa, H., Ohishi, N. & Yagi, K. (1979). Assay for lipid peroxides in animal tissues by thiobarbituric acid reaction. *Analytical biochemistry*, 95(2), 351-358.

Onwurah, F., Okejim, J. & Amaefula, K. (2013). Effect of yeast as water additive in the management of litter in the production starter broiler. *J Asian J Nat Appl Sci*, 2, 27-30.

Reitman, S. & Frankel, S. (1957). A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. *J American journal of clinical pathology*, 28(1), 56-63.

Rezaeipour, V., Fononi, H. & Irani, M. (2012). Effects of dietary L-threonine and *Saccharomyces cerevisiae* on performance, intestinal morphology and immune response of broiler chickens. *J South African Journal of Animal Science*, 42(3), 266-273.

Rodkey, F. L. (1965). Direct spectrophotometric determination of albumin in human serum. *J Clinical Chemistry*, 11(4), 478-487.

Sagbaug, M. (2003). Heavy duty magnetic water condition.

Santin, E., Paulillo, A., Nakagui, L., Alessi, A. & Maiorka, A. (2006). Evaluation of yeast cell wall on the performance of broiles fed diets with or without mycotoxins. *J Brazilian Journal of Poultry Science*, 8(4), 221-225.

Shah, D. & Nagarajan, N. (2013). Luteal insufficiency in first trimester. *J Indian journal of endocrinology metabolism*, 17(1), 44.

Shankar, P., Premavalli, K., Omprakash, A., Kirubakaran, J., Hudson, G. & Vairamuthu, S. J. I. V. J. (2018). Effect of dietary yeast supplementation on serum biochemical profile of broiler chicken. 95(6), 13-15.

Shankar, P. A., Premavalli, K., Omprakash, A., Kirubakaran, J. J. & Hudson, G. (2017). Effect of dietary yeast supplementation on the production performance of broilers. *J Int J Adv Biol Res*, 7, 222-228.

Singh, R. B., Tomar, R. S., Chauhan, A. K., Yadav, P. &

Khan, S. (2019). Estimates of functional foods availability in the 10 most highly populous countries. *J The role of functional food security in global health*, 25-42.

Trinder, P. (1969a). Enzymatic colorimetric method for determination uric acid. *J Ann. Clin. Biochem*, 6, 24-30.

Trinder, P. (1969b). Enzymatic Colorimetric method for estimation of Glucose Test (GOD-PAP method), uric acid and phospholipids. *J Ann Clin Biochem*, 6, 25.

Tzianabos, A. O. (2000). Polysaccharide immunomodulators as therapeutic agents: structural aspects and biologic function. *J Clinical microbiology reviews*, 13(4), 523-533.

Wahyono, N. & Utami, M. (2018). A review of the poultry meat production industry for food safety in Indonesia. *Journal of Physics: conference series*, 2018. IOP Publishing, 012125.

Zijlstra, N. C. (1960). Estimation of hemoglobin. *Clin. Chem. Acta*, 5, 519.

المخلص العربي التأثيرات الباثولوجية الاكلينيكية للمياه الممغنطة و الخميرة كمكمل غذائي على بدارى التسمين

أجريت هذه الدراسة على 40 كتكوت عمر يوم واحد بدراي تسمين لتقييم تأثير الماء المعالج مغناطيسيا والخميرة لمدة خمسة أسابيع متتالية على معدلات الأداء والنمو وصورة الدم وبعض تحاليل الدم البيوكيميائية والاستجابة المناعية. تم تقسيم هذه الكتاكيت إلى أربع مجموعات متساوية كالتالي: المجموعة الأولى: تركت كمجموعة ضابطة بدون أي إضافات. المجموعة الثانية: أضيف إليها الماء المعالج مغناطيسيا. المجموعة الثالثة: أضيف إليها الخميرة في الماء بنسبة 0,8 جم لكل لتر. المجموعة الرابعة: أضيف إليها الماء المعالج مغناطيسيا بالإضافة إلى الخميرة بنسبة 0,8 جم لكل لتر. وقد لوحظ عدم وجود زيادة معنوية في وزن بداري التسمين ووزن الجسم المكتسب. بينما لوحظ نقص معنوي في كمية العلف المستهلكة و معدل التحويل الغذائي بالمجموعات المتغذية علي الماء المعالج مغناطيسيا و الخميرة، بينما لا يوجد تغيير في كمية العلف في المجموعة المتغذية علي الماء المعالج مغناطيسيا والخميرة معا. و عدم وجود تغيير معنوي في كريات الدم الحمراء، الهيموجلوبين، متوسط حجم كرات الدم، نسبة الهيماتوكريت بالمجموعات المتغذية علي الماء المعالج مغناطيسيا و الخميرة. ولوحظ وجود زيادة معنوية في عدد كريات الدم البيضاء بالمجموعات المتغذية علي الماء المعالج مغناطيسيا و الخميرة، بينما لا يوجد تغيير في المجموعة المتغذية علي الماء المعالج مغناطيسيا والخميرة معا. و نقص معنوي في ناقل امين الالانين بالمجوعات المتغذية علي الماء المعالج مغناطيسيا و عدم وجود تغيير في ناقل الاسبرتات الاميد في جميع المجموعات. عدم وجود تغيير في نسبة البروتين والألبومين والجلوبيولين و الجلوكوز و حمض اليوريك و الكرياتينين في جميع المجموعات. و عدم وجود تغيير في نسبة تثنائي الدهيد المألون و الجلوتاتيون المختزل بالمجوعات المتغذية علي الماء المعالج مغناطيسيا و الخميرة كلا علي حدة وفي المجموعتين معا. و زيادة معنوية في مستوي الإنترلوكين 6 عند استخدام الماء المعالج مغناطيسيا والخميرة، بينما قل مستوي الإنترلوكين 10 بالمجموعات المتغذية علي الماء المعالج مغناطيسيا و الخميرة و عدم وجود تغيير في المجموعتين معا. وقد خلصت الدراسة الي ان استخدام المياه الممغنطة والخميرة لها تأثير ايجابي علي الاوزان وليس لها اي اضرار علي وظائف الكبد و الكلى في بدارى التسمين.

الكلمات الدالة (الراشدة): بدارى التسمين، المياه الممغنطة، الخميرة، الاجهاد التأكسدي.