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Impact of magnetically treated water on milk traits and blood biochemical changes of Awassi ewes during pre- and post-partum

ABSTRACT

The objective of this study was to evaluate the benefit of magnetically treated water (MTW) using in Awassi ewe's farm during pre- and post-partum on lactating and some blood biochemical traits determination. This experiment was carried out in a private sheep raising sector, from September to December of 2021. Twenty-four Awassi ewes at 120-d of gestation, age 2.5-3-year, live weight of 50-55 kg, the ewes were distributed on four treatments: T0 the control (served drinking well water), T1 (magnetized water by using a device at strength 2000 gauss), T2 (magnetized water by using a device at strength 4000 gauss) and T3 (magnetized water by using a device at strength 6000 gauss) .

The results of using magnetically treated water led to increasing milk yield, improving milk physical (freezing point, PH) and chemical (fat, protein, lactose, SNF) characteristics, also improving the blood biochemical parameters concentration (total protein, HDL, oxidative enzyme LDH- Lactate dehydrogenase), however the MTW treatments led to decreasing the concentration of (creatinine, RBS (Glucose), total cholesterol (TCH), LDL and triglycerides (TG), enzymes: AST, ALT and ALP) concentrations at both pre- and post-partum periods in the all treatments of MTW compared with control T0. Finally, the results of 6000 gauss treated water show separatory then 4000 gauss in all parameters of the study.

INTRODUCTION

Water is a crucial component for maintaining life as well as for improving growth rate, milk production and reproduction in animals (Umar *et al.*, 2014). Water accounts for around 70-80 percent of animals at birth and 65-70 percent of adult live weight, depending on age, fat cover, and physiological condition (Wakchaure *et al.*, 2015). Water is involved in a variety of vital body functions, including thermoregulation, lubrication, chemical reactions medium, hormones, digestion, absorption, wastes excretion, oxygen, transport of nutrients, carrier, lactation, cushion, support, mineral balance and assisting other nutrient to complete their functions (Hersom and Crawford, 2008).

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Water is essential not only for the proper functioning of the body, but it is also the most important ingredient in the diet of some animals and the development of plants. A significant percentage of the water in the world is used in agriculture practices (USDA, 2016). Several strategies are now being utilized to improve water quality, one of which involves the application of magnetic forces to magnetize the water. Magnetic water, also known as magnetized water, is water that has been exposed to a magnetic field. Magnetically treated water (also known as anti-scale magnetic treatment or AMT) is a way of minimizing the effects of hard water prepared by exposing tap water to a magnetic field as a non-chemical alternative to water softening (Ali *et al.*, 2014). Water's physical, chemical, physicochemical, and biophysical properties can be altered by a magnetic field, leading to specific functionalities (Alattar *et al.*, 2021). Magnetic water has been employed for decades in different fields, including, agriculture, medical, industry, and the environment (Ali *et al.*, 2014). Some of the primary advantages of using magnetic water in agricultural techniques are increased water and soil quality, increased germination rate, crop yields, improved livestock health and elimination of scale formation in pipes (Yacout *et al.*, 2015).

Dairy cows that drink magnetic water produce more milk with the same amount of milk fat as cows that drink normal water; they also have a longer lactation period with fewer non-productive days, and their overall health is better (Lin and Yotvat, 1990). Improvements in milk yield were linked to increases in fat and protein production in animals drink magnetic water (Al-Maro, 2011).

This study planned to evaluate the impact of magnetically treated water at strength 2000, 4000 and 6000 gausses on Awassi ewes lactating blood protein, fat, some oxidative enzymes and hormones determinations at pre- and post- partum periods.

MATERIALS AND METHOD

This experiment was carried out at Kosar sheep farm in Kawergosk District–Erbil Governorate. For the period 1st October to 30th December 2021. Twenty-four partum Awassi ewes at ages 2-2,5 years and average weights between 55-60 kg were distributed according to age and weight into four treatments (6 ewes / treatment). Ewes emplaced in four adjacent pens half opened with area 20 m². Drinking water magnetically treated by using dipole (Magnetotron) which manufactured in Dubai-United Arab Emirates (UAE). The drinking water source in the four treatments is well water, the treatments are following: T0 (t control ewes drink well water), T1 (ewes drink 2000 gauss magnetized treated water (MTW), T2 (ewes drink 4000 gauss MTW) and T3 (ewes drink 6000 gauss MTW). The water flow through north pole to south pole of the three devices.

Food served two times a day of live body weight, in two meals morning and evening. Ewes in all treatments were consumed 1 kg concentrated diet in two batch contain (45% black barley, 30% wheat bran, 22 yellow corn, 1% urea, 1% bentonite and 1% limestone and) with a content of 14.90 % crude protein and 2450 kcal/kg), also served 700 g of straw in two batch. The minerals blocks were present in front of the bulk always. Animals grazing every day 2-3 hours in the pastures of the station itself away from any source of drinking water during the study period. The ewes were placed in different colors using the local dye (seductive) to distinguish and ease of isolation. The newborns were isolated from their mothers in the morning. After they were milked in the morning to empty the udder. Milk production and the samples were preserved (20 ml) by putting all sample in the ice box until testing. Physio-chemical properties (Fat %, Protein%, Lactose %, Solid Not Fat (SNF) % and Freezing point) were determined by Lactostar “FUNKE GERBER” Labortechnik (12/05) machine (Germany) at the Food Technology Laboratory of Agriculture Engineering Sciences/ Salahaddin University-Erbil. The pH of milk samples measured by portable pH meter.

Blood sampling and biochemical analyses: The blood samples were withdrawn from all ewes in early morning before food intake at 1-week pre-partum and first week post-partum. The blood sample (10 ml) were taken from each ewe by jugular vein was placed in two sample tubes (5ml) tubes, the 1st 5ml tube of blood samples with EDTA placed in the complete blood cells counter device for measuring (RBC and WBC profiles), the tubes of blood samples without EDTA were centrifuged at 3500 rpm for 15 min and the plasma collected was kept frozen at −20°C until used for the blood parameters analysis. Biochemical analysis serum concentration of glucose (RBS),

protein and lipid profiles, prolactin, progesterone and growth hormone were tested by ELISA Kits from CUSABIO Technology LLC – Bio-compare. Antioxidant enzymes ALP, AST and ALT tests using commercial colorimetric kits of Diagnostic Products Corporation, (DCP) Los Angles, USA. Statistical data were analyzed using CRD (Completely Randomized Design) by the SAS institute program (SAS, 2005). Duncan's multiple range tests were used to compare differences between the treatments.

RESULTS

Table 1 shows the milk yield in Awassi ewes that treated with 6000 gausses magnetically (MTW) water of significantly increased (P≤0.05) at (1 month and 3d pre-partum) and 3d post-partum, also significantly increased (P≤0.01) in the all treatments at post-partum compared with control (T0). Also, freezing point of milk in Awassi ewes obviously significantly higher (P≤0.05) in 6000 and 4000 gausses MTW compared with other treatments at (1 month pre-partum), while 3day pre-partum didn't shows any difference among the treatment, as well as, 1-month post-partum significant higher (P≤0.01) in the all MTW treatments compared with control T0, while 3day shows significantly higher (P≤0.05) freezing point only in 6000 gauss compared with control and other treatment. While, PH of milk in Awassi ewes had shown insignificant differences among all treatment at (1month and 3d) pre-partum, however; 6000 gauss (T3) significantly higher (P≤0.05) PH at post-partum compared with T1 and the control (T0).

Table (1): Effect of magnetically treated water of Awassi ewes on milk yield and some milk physical characteristics pre & post-partum

Traits	Treatments	Pre-partum		Post-partum	
		1 month	3 days	3 days	1 month
Milk yield (L)	T0	0.145 ^{b}	0.112 ^{b}	0.269 ^{b}	0.429 ^{c}
	T1	0.165 ^{b}	0.133 ^{b}	0.295 ^{b}	0.533 ^{b}
	T2	0.198 ^{ab}	0.175 ^{ab}	0.387 ^{ab}	0.640 ^{ab}
	T3	0.283 ^{a}	0.260 ^{a}	0.418 ^{a}	0.735 ^{a}
	SE	0.027	0.019	0.022	0.033
	S.L	*	*	*	*
Freezing point (-C°)	T0	0.479 ^{b}	0.581 ^{a}	0.862 ^{b}	0.529 ^{c}
	T1	0.595 ^{ab}	0.590 ^{a}	0.858 ^{b}	0.585 ^{b}
	T2	0.732 ^{a}	0.593 ^{a}	0.919 ^{ab}	0.602 ^{b}
	T3	0.783 ^{a}	0.606 ^{a}	1.258 ^{a}	0.849 ^{a}
	SE	0.102	0.106	0.119	0.107
	S.L	*	N.S	*	**
PH	T0	6.70 ^{a}	6.77 ^{a}	6.46 ^{b}	6.65 ^{b}
	T1	6.68 ^{a}	6.78 ^{a}	6.60 ^{ab}	6.68 ^{b}
	T2	6.70 ^{a}	6.78 ^{a}	6.76 ^{ab}	6.75 ^{ab}
	T3	6.72 ^{a}	6.81 ^{a}	6.99 ^{a}	6.83 ^{a}
	SE	0.40	0.33	0.31	0.29
	S.L	N.S	N.S	*	*

T0: control (well water), **T1:** 2000 gauss MTW (magnetically treated water), **T2:** 4000 gauss MTW**, T3:** 6000 gauss MTW**. NS:** means insignificant rows with the same superscripts.

^{a,b,c} Means within columns with different superscripts differ significantly at *(P≤ 0.05) &** (P≤ 0.01).

Table (2) shows the fat % in milk of Awassi ewes had insignificant differences at (1 month) pre-partum among all treatment, whereas 3d pre-and post-partum and 1month post-partum shows significantly lower (P≤0.05) fat % in the treatments T2 (40000 gauss) and T3 (6000 gauss) compared with T1 and T0. Also (3 day and 1 month) post-partum T3 shows increased significantly (P≤0.05) compared with T1 and control, but insignificantly differences with T2. The protein % of milk in Awaasi ewes that treated with 6000 gauss increased significantly (P≤0.05) as compared

with other treatment at 1 month pre-partum, while 3d pre-partum shows T3, T2, T1 increased significantly compared with control (T0) respectively. Also (3 day and 1 month) post-partum T3, T2 and T1 shows increased significantly (P≤0.01) compared with control (T0). The lactose % in milk shows significantly higher (P≤0.05) in all treatments of MTW at 1 month pre-partum and all treatment s of MTW at 3d pre-partum compared with control T0, while insignificant differences among all treatments and control at 3d at the same period. Also, significantly higher (P≤0.01) lactose % in milk at 3d and 1month post-partum in T2 and T3 compared with control (T0).

Table (2): Effect of magnetically treated water of Awassi ewes on some milk chemical characteristics pre & post-partum

Traits	Treatments	Pre-partum		Post-partum	
		1 month	3 days	3 days	1 month
Fat %	T0	6.02 ^{a}	7.81 ^{a}	7.37 ^{a}	6.40 ^{a}
	T1	6.20 ^{a}	7.25 ^{ab}	7.41 ^{a}	6.02 ^{ab}
	T2	6.36 ^{a}	6.57 ^{b}	8.00 ^{b}	5.74 ^{b}
	T3	5.72 ^{a}	6.16 ^{b}	8.28 ^{b}	5.43 ^{b}
	SE	0.39	0.33	0.41	0.35
	S.L	N.S	*	*	*
Protein %	T0	2.93 ^{b}	3.17 ^{b}	7.13 ^{c}	4.5± ^{c}
	T1	3.54 ^{ab}	3.99 ^{a}	7.63 ^{b}	4.86 ^{bc}
	T2	3.77 ^{ab}	4.00 ^{a}	8.21^{ab}	5.07 ^{b}
	T3	4.37 ^{a}	4.12 ^{a}	8.90 ^{a}	5.79 ^{a}
	SE	0.29	0.23	0.55	0.21
	S.L	*	*	**	**
Lactose %	T0	6.42 ^{b}	5.23 ^{a}	6.57 ^{c}	4.98 ^{c}
	T1	7.21 ^{a}	5.31 ^{a}	6.92 ^{bc}	5.20 ^{bc}
	T2	7.51 ^{a}	5.42 ^{a}	7.57 ^{b}	5.46 ^{b}
	T3	7.27 ^{a}	5.51 ^{a}	12.39 ^{a}	7.54 ^{a}
	SE	0.52	0.39	0.47	0.31
	S.L	*	N.S	**	**
SNF %	T0	12.88 ^{c}	9.62 ^{b}	14.42 ^{c}	9.16 ^{c}
	T1	17.12 ^{b}	9.97 ^{ab}	15.08 ^{bc}	9.82 ^{bc}
	T2	17.71 ^{b}	10.12 ^{ab}	17.25 ^{b}	10.23 ^{b}
	T3	19.80 ^{a}	10.44 ^{a}	22.03 ^{a}	14.49 ^{a}
	SE	0.67	0.53	0.79	0.62
	S.L	**	*	**	**
FCM; % 6 (kg/d)	T0	0.419 ^{c}	0.420 ^{b}	0.953 ^{c}	1.320 ^{c}
	T1	0.492 ^{b}	0.464 ^{ab}	1.051 ^{b}	1.543 ^{b}
	T2	0.605 ^{ab}	0.553 ^{ab}	1.489 ^{ab}	1.766 ^{ab}
	T3	0.778 ^{a}	0.770 ^{a}	1.664 ^{a}	1.919 ^{a}
	SE	0.101	0.092	0.14	0.10
	S.L	**	*	**	**
EVL (Mcal/ kg)	T0	521.2 ^{b}	531.7 ^{a}	601.9 ^{b}	468.3 ^{b}
	T1	605.4 ^{a}	516.2 ^{a}	615.4 ^{b}	465.5 ^{b}
	T2	6.22.4 ^{a}	492.4 ^{a}	678.0 ^{ab}	462.0 ^{b}
	T3	635.4 ^{a}	482.2 ^{a}	775.9 ^{a}	527.5 ^{a}
	SE	17.00	13.20	11.58	9.13
	S.L	*	N.S	*	*

T0: control (well water), **T1:** 2000 gauss MTW (magnetically treated water), **T2:** 4000 gauss MTW**, T3:** 6000 gauss MTW**.** **NS:** means insignificant rows with the same superscripts. **FCM; 6%:** Fat-corrected milk as well as **milk energy content** (EVL; KJ/kg) were calculated based on the following equations as described by Milis [13], and then, EVL was converted to Mcal/kg: **FCM** (% 6, kg/d) = L (kg/d) × [0.472 + 0.0088 × F (g/kg)], **EVL** (Mcal/kg) = 39 × F + 18.2 × SNF + 52.

[a,b,c] Means within columns with different superscripts differ significantly at *(P≤0.05) &** (P≤0.01).

The SNF % in milk significantly increases (P≤0.01) in T1, T2 and T3 at (1 month) pre-partum, also it significantly higher (P≤0.05) in T3 at 3d pre-partum compared with the control. The FCM; %6 (Fat-corrected milk) had significantly higher (P≤0.01) in the all treatments of MTW at (1 month) pre-partum and (3d and 1 month) post-partum compared with control T0, also significantly increased (P≤0.01) on the T3 compared with among treatment. The EVL (milk energy content) (Mcal/kg) shows significantly higher (P≤0.05) in all MTW treatments at 1 month pre-partum compared with the control T0, whereas at 3d pre-partum had shown insignificant differences among all treatment. Thus, at (3d and 1 month) post-partum the EVL had shown significantly increases (P≤0.05) in T3 compared with the control.

Table (3) presented the concentration of total protein in blood serum of Awassi ewes had significantly increased (P≤0.05) in T3 at Pre-partum, also at post-partum all treatments of MTW show significantly higher (P≤0.01) compared with control T0. The concentration of creatinine in blood serum had significantly lower (P≤0.05) at all treatments of MTW compared with control T0 at both Pre-and post-partum. The RBS (Glucose) concentration in blood serum had significantly lower (P≤0.05) in the all treatments of MTW at pre-partum compared with control T0, however; it significantly higher (P≤0.01) in the all treatments of MTW compared with T0 at post-partum.

Table (3): Effect of magnetically treated water of Awassi ewes on the antioxidant enzymes activity at pre- and post-partum

Traits	Animal category	Biochemical of blood (mg/dl)				SE	S.L
		T0	T1	T2	T3		
Total protein	Pre-partum	4.69 [b]	5.30 [ab]	5.55 [ab]	5.90 [a]	0.101	*
	Post-partum	5.18 [c]	6.15 [b]	6.45 [b]	7.12 [a]	0.127	**
creatinine	Pre-partum	0.409 [a]	0.324 [b]	0.330 [b]	0.305 [b]	0.062	*
	Post-partum	0.738 [a]	0.618 [b]	0.607 [b]	0.571 [b]	0.033	*
RBS (Glucose)	Pre-partum	44.0 [a]	40.5 [b]	40.2 [b]	39.6 [b]	1.75	*
	Post-partum	75.4 [c]	77.5 [b]	79.8 [ab]	81.0 [a]	2.39	**

T0: control (well water), **T1:** 2000 gauss MTW (magnetically treated water), **T2:** 4000 gauss MTW**, T3:** 6000 gauss MTW**. RBS**: random blood sugar. [a,b,c] Means within columns with different superscripts differ significantly at *(P≤0.05),** (P≤0.01).

The results in Table (4) shows significantly lower (P≤0.01) of blood serum concentrations of total cholesterol (TCH), LDL and triglycerides (TG) in Awassi ewes' at (pre- and post-partum) in the all treatments of MTW compared with control T1. Otherwise, the HDL concentration had significantly higher (P≤0.01) at both pre- and post-partum) in the all treatments of MTW compared with the control T0.

Table (4): Effect of magnetically treated water of Awassi ewes on the lipid profile at pre- and post-partum

Traits	Animal category	Lipid profile (mg\dl)				SE	S.L
		T0	T1	T2	T3		
TCH	Pre-partum	132.0 [a]	120.1 [b]	110.7 [bc]	107.5 [c]	3.75	**
	Post-partum	102.4 [a]	96.9 [b]	93.8 [bc]	90.1 [c]	2.97	**
HDL	Pre-partum	14.67 [c]	16.39 [b]	18.97 [ab]	19.75 [a]	1.03	**
	Post-partum	20.08 [c]	25.89 [b]	27.33 [ab]	29.21 [a]	1.67	**
LDL	Pre-partum	67.00 [a]	60.62 [b]	61.65 [b]	51.20 [c]	1.86	**
	Post-partum	44.82 [a]	41.39 [b]	39.44 [b]	35.71 [c]	1.45	**
TG	Pre-partum	51.33 [a]	43.09 [b]	40.46 [b]	36.55 [c]	1.90	**
	Post-partum	37.50 [a]	29.62 [b]	27.03 [bc]	25.18 [c]	0.94	**

T0: control (well water), **T1:** 2000 gauss MTW (magnetically treated water), **T2:** 4000 gauss MTW**, T3:** 6000 gauss MTW**. TCH**: Total cholesterol, **HDL**: High density lipoprotein, **LDL**: Low density lipoprotein, **TG**: Triglycerides.

[a,b,c] Means within columns with different superscripts differ significantly at *(P≤0.05) and** (P≤0.01).

The results in Table (5) shows oxidative enzyme LDH (Lactate dehydrogenase) concentration in blood serum had significantly higher (P≤ 0.01) at both pre- and post-partum, also AST concentration at pre-partum in the all treatments of MTW compared with control T0. While, AST concentration at post-partum had significantly lower (P≤0.01) in blood serum of all treatments served MTW, also ALT at post-partum and ALP concentrations at both pre- and post-partum had significantly lower (P≤0.05) in blood serum of all MTW treatments compared with control T0. Whereas, the blood serum of ALT concentration had insignificant differences among all treatments.

Table (5): Effect of magnetically treated water of Awassi ewes on the antioxidant enzymes activity at pre- and post-partum

Traits	Animal category	Oxidative enzymes (U/L)				SE	S.L
		T0	T1	T2	T3		
LDH	Pre-partum	316.8 [c]	377.5 [b]	449.3 [ab]	493.6 [a]	11.3	**
	Post-partum	417.3 [c]	492.0 [b]	529.9 [ab]	571.3 [a]	19.5	**
AST	Pre-partum	63.8 [d]	68.2 [c]	72.4 [b]	84.5 [a]	2.71	**
	Post-partum	77.1 [a]	73.5 [b]	71.3± [bc]	68.3 [c]	2.44	**
ALT	Pre-partum	20.04 [a]	20.45 [a]	20.71 [a]	21.17 [a]	0.83	N.S
	Post-partum	18.33 [a]	16.42 [b]	15.75 [b]	15.96 [b]	1.05	*
ALP	Pre-partum	159.1 [a]	163.0 [b]	165.3 [b]	167.8 [b]	5.91	*
	Post-partum	170.63 [a]	175.3 [b]	180.5 [b]	181. 3 [b]	13.8	*

T0: control (well water), **T1:** 2000 gauss MTW (magnetically treated water), **T2:** 4000 gauss MTW**, T3:** 6000 gauss MTW**. LDH** :(Lactate dehydrogenase), ALP (alkaline Phosphatase)- AST (Aspartate aminotransferase), ALT (Alanine aminotransferase), **NS:** means insignificant rows with the same superscripts).[a,b,c] Means within columns with different superscripts differ significantly at *(P≤ 0.05) &** (P≤ 0.01).

Table (6) represent the hormones concentrations in of blood serum of Awassi ewes. The results of progesterone and growth hormone concentrations had insignificant differences among all treatment at pre-partum, but at post-partum the progesterone and growth hormone concentrations significantly higher (P≤0.05) in the all treatments of MTW compared with control T0. Also, prolactin hormone had significantly higher (P≤0.05) in the all treatments of MTW compared with control T0 respectively at both pre-and post-partum.

Table (6): Effect of magnetically treated water of Awassi ewes on some hormones profile at pre- and post-partum

Hormones	Animal category	Hormones (ng/ml)				SE	S.L
		T0	T1	T2	T3		
Progesterone	Pre-partum	3.03 [a]	3.16 [a]	3.18 [a]	3.27 [a]	0.119	N.S
	Post-partum	0.25 [b]	0.33 [a]	0.35 [a]	0.38 [a]	0.025	*
Prolactin	Pre-partum	21.5 [c]	27.3 [b]	29.0 [ab]	33.2 [a]	1.08	**
	Post-partum	92.0 [c]	112.7 [b]	120.0 [ab]	125.4 [a]	3.75	**
Growth hormone	Pre-partum	0.46 [a]	0.50 [a]	0.53 [a]	0.57 [a]	0.145	N.S
	Post-partum	0.57 [b]	0.68 [ab]	0.75 [a]	0.86 [a]	0.052	*

T0: control (well water), **T1:** 2000 gauss MTW (magnetically treated water), **T2:** 4000 gauss MTW**, T3:** 6000 gauss MTW**. NS:** means insignificant rows with the same superscripts.
[a,b,c] Means within columns with different superscripts differ significantly at *(P≤ 0.05) and ** (P≤ 0.01).

DISCUSSION

Our findings are consistent with Al-Maro (2011) and Shamsaldain and Al Rawee (2012) they noted a significant increase in milk production with ewe's drink intensity magnetic water compared to tap water. The results of milk composition agreed with Kim *et al.* (2015) found that cow milk when drink MTW had better fat in milk, and. Al-Maro (2011) noted that MTW increased Awassi ewes milk fat, protein, lactose and SNF. As well as Yacout *et al.* (2015) observed that Zaraibi does drinking MTW had significantly higher milk contents of TS, SNF, fat, protein and lactose than control which drink tap water. The improvement in milk output and its composition can be attributed to the beneficial impact of magnetic water on digestion; absorption; cellular growth and its functions; circulatory system and udder (Barrett, 2002; Ghoneim *et al.*, 2020), also the ewes that consumed 4000 and 6000 gausses MTW increased the secretion of the prolactin, Progesterone and growth hormone especially post-partum as shown in Table (6) which positively effect on milk yield. Yacout *et al.* (2015) reported that Zaraibi goats drank magnetic water at the levels of 1200 and 3600 gausses showed a significant increase in serum total protein concentration compared with drank un-magnetic water. Elevation of blood total protein by magnetic water treatment may play positive role in an increase in growth and the consumption of protein to build somatic cells, and indicated maintenance of cellular functions, the change in protein metabolism and EMF also interacts directly with electrons in DNA to affect protein biosynthesis (Khalisa and Ali, 2012).

Bellokossy (2000) noted that magnetically treated water leads to an increase in the growth rate and milk production, due to the fact that drinking magnetically treated water reduces the surface tension of water, and increases the surface tension and permeability in cells, and that the increased surface tension allows the expansion of the alimentary canal and this works on increasing the benefit from the food intake, and Mahjoub (1999) showed that magnetically treated water activates the building processes inside cells and reduces the percentage of demolition processes that occur inside the body due to the increase in oxygen and nutrients inside the cells. Remedy (2006) confirmed that drinking magnetically treated water causes A tremendous improvement in health and helps improve the absorption of minerals and vitamins that improve detoxification, as well as a powerful antioxidant that protects the body from the harmful effects of free radicals and is able to reduce acids while increasing the ionization of oxygen, thus improving digestion and giving water a much better taste. And magnetically treating water turns it into (functional water or living water), which becomes more vital and biologically active because it helps improve blood movement and its delivery to the tissues and cells of the body and has the property of dissolving oxygen to a high degree; Which makes the cells and tissues of the body to breathe better and improve the performance of vital processes (Habbas, 2004), and the high permeability of magnetically treated water helps in the decomposition of nutrients and improves the absorption of nutrients, minerals and water in the body (Gold-Aqua, 2005)

There is decreasing in level of creatinine in the blood serum of Awassi ewes significantly ($P \leq 0.05$) at all treatments of magnetically treated water compared with control group at both pre- and post-partum. This result not agree with (El-Hanoun *et al.*, 2017), who observed a significant increase in their level of plasma creatinine (a product of protein breakdown) compared with other treatments, this may be due to differences in the breed or to the health status of animals during study.

Level of RBS (glucose) in the blood serum of Awassi ewes had decreased significantly ($P \leq 0.05$) in the all treatments of MTW at pre-partum compared with natural water. This finding is confirmed with Alhammer *et al.* (2013) showed that MTW has 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, also it significantly higher ($P \leq 0.01$) in the all treatments of MTW compared with NW at post-partum. These results agreed with (Yacout *et al.*, 2015), who noticed that Zaraibi goats drank magnetic water showed a significant increase in glucose level compared with drank un-magnetic water.

Rokicki (2006) found that magnetization attracts iron in the blood, and then Bringing more blood to the area, meaning an increase in red blood cells and hemoglobin, and thus carrying more oxygen to the cells. And a decrease in its sedimentation rate (ESR), and Jain (2000) indicated that magnetic

treatment increases the number of crystallization centers in the liquid, which leads to the strength of the magnetic field, and when it enters the body, it generates a weak electric current that increases the amount of ions and increases the ionized blood beneficial to the body. McCreery (2003) noted that drinking magnetically treated water increases the solubility of minerals, improves the transport of nutrients to all parts of the body, makes living organisms work more efficiently, increases the formation of blood platelets, increases the number of red blood cells, and then increases the ability of Iron-containing hemoglobin transports more oxygen to different cells and tissues of the body and carries carbon dioxide to be excreted through the lungs more efficiently (Inc., Life, 2003). And that the high levels of hemoglobin concentration in the blood of animals that consumed magnetically treated water can be explained in two ways. Like the liver, spleen and bone marrow on blood production and increase hemoglobin implicitly (Davidson, 2000) and that blood contains in its composition a large proportion of water. A magnetic field leads to an increase in its ability to dissolve oxygen, which is reflected in the rise in hemoglobin in the blood of animals that ingested magnetically treated water (Nasser, 2006).

In the study (Yacout *et al.,* 2015) goats received MTW showed a significant reduced ALT and AST (improvement of liver functions) when compared to those of goats that drank un-magnetic water. On the other hand, no significant changes in both aspartate aminotransferase and alkaline phosphatase activities, and highly significant increase in adenosine deaminase activity were recorded in the magnetically treated water groups comparing to control group (Alhammer *et al.,* 2013). Effect of drinking treated water on the kidney function parameters, showed that treatments at the levels of 1200 and 3600 gausses caused a significant ($P< 0.05$) decrease in AST and ALT than un-magnetic water. So, these parameters showing improved renal and liver function due to magnetic treatment (Attia *et al.,* 2015; Yacout *et al.,* 2015). These improvement in the function of liver, kidney and antioxidants enzymes could be explain based on the effect of magnetic treatments to improving solubility of minerals of water, which facilities the transfer of the nutrients via improving membrane permeability to animal cells, thus nutrients uptakes and utilization as the water is the media for all biological and metabolic reactions (El-Hanoun, 2014).

(Davis and Rawls, 1996; Lynch, 2000) indicated that magnetically treated water activates enzymes and acts as a coenzyme cofactor so that it helps the enzyme to take its shape and increase the efficiency and activation of enzyme sites. The decrease in the activity of the enzymes GOT and GPT in the serum of ewes may be due to the increase in the concentration of total protein in the blood serum in blood serum. Or it may be that the use of magnetically treated water reduced the body's need to synthesize energy from protein sources, and then reduced the activity of the two enzymes GOT and GPT in the blood serum. Siegle (1980) indicated that the function of these two enzymes is to transfer the amino group from amino acids to ketone acids. And the increase in the activity of ALP enzyme in the serum of magnetic water treatment treatments compared to the control group, as the high activity of this enzyme in the blood serum may reflect the increased demand for this enzyme resulting from its great use in metabolic processes and protein synthesis in the liver, as indicated by Meissner (1981). This is clearly indicated by the high rate of milk production.

CONCLUSION

On the basis of the results obtained we conclude that: ewes consuming magnetically treated water at 4000 and 6000 gausses improved milk yield, composition and all physiological characteristics of blood.

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تأثير الماء المعالج مغناطيسيا على صفات الحليب والتغيرات البيوكيميائية في دم النعاج العواسية خلال فترة قبل وبعد الولادة

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الكلمات المفتاحية:
المياه المغناطيسية ، النعجة ، صفات الحليب ، صفات الدم ، هرمونات المصل والإنزيمات.

الخلاصة

الهدف من هذه الدراسة هو تقييم فائدة الماء المعالج مغناطيسيا (MTW) التي استخدمت في مزرعة النعاج العواسية خلال فترة قبل و بعد الولادة وتأثيرها على مكونات الحليب وتحديد بعض الصفات البيوكيميائية في الدم. أجريت هذه التجربة في مزرعة لتربية الأغنام قطاع خاص في الفترة من أيلول إلى كانون الأول من عام 2021. تم توزيع 24 نعجة عواسية بعمر 120 يوم من الحمل ، تتراوح أعمارهم بين 2.5-3 سنوات ، ووزن حي من 50-55 كجم ، تم توزيع النعاج عشوائيا على أربعة معاملات: T0 السيطرة (ماء البئر) ، T1 (ماء ممغنط باستخدام جهاز بقوة 2000 غاوس) ، T2 (ماء ممغنط باستخدام جهاز بقوة 4000 غاوس) و T3 (ماء ممغنط باستخدام جهاز بقوة 6000 جاوس).

أدت نتائج استخدام المياه المعالجة مغناطيسيًا إلى زيادة إنتاج الحليب ، وتحسين خصائص الحليب الفيزيائية (درجة التجمد، PH) والكيميائية (الدهون ، البروتين ، اللاكتوز ، SNF) ، وكذلك تحسين تركيز الصفات الكيموحيوية للدم (البروتين الكلي ، HDL ، الإنزيم المؤكسد LDH- اللاكتات ديهيدروجينيز) ، إلا أن معاملات MTW أدت إلى تقليل تركيز (الكرياتينين ، RBS (الجلوكوز) ، الكوليسترول الكلي (TCH)، LDL والدهون الثلاثية (TG) ، الإنزيمات: AST، ALT و ALP) في فترة ما بعد الولادة في جميع معاملات MTW مقارنة مع التحكم T0. أخيرًا ، أظهرت نتائج 6000 جاوس المياه المعالجة مغناطيسيا ثم 4000 جاوس في جميع معاملات الدراسة.