Hematological and Biochemical Study of Zinc deficiency in Sheep in Fallujah city /Iraq

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Abstract

The current study was conducted to estimate the Zinc(Zn) levels in serum of (190) Awassi sheep (males) in Fallujah city/ Iraq. The animals were examined clinically and serum samples were examined by atomic absorption spectrophotometer (AAS) to detect the Zn concentration, the results showed decrease in zinc level in addition to significant ($P \leq 0.05$) difference between among the control group 0.67 ± 0.42 ppm and affected which include Al-bushegel group0.21 ± 0.42 ppm, Al-falaahat group0.18 ± 0.12 ppm and Al-bualwaan group0.13 ± 0.27 ppm. Also, RBCs reduced in Al-bushegel group$6.88 \pm 0.51^*$ 10^6/ul, Al-falaahat group$7.03 \pm 0.26^*$ 10^6/ul, and Al-bualwaan group$6.37 \pm 0.84^*$ 10^6/ul, thus Hb declined in Al-bushegel group 7.13 ± 0.22g/dl, Al-falaahat group 7.27 ± 0.32g/dl, and Al-bualwaan group 6.82 ± 0.43g/dl in the whole blood samples. PCV was also significant ($P \leq 0.05$) reduced in Al-bushegel group $21.41 \pm 0.53\%$, Al-falaahat group $21.75 \pm 0.48\%$, and Al-bualwaan group $20.21 \pm 0.15\%$. On the other hand, the results showed an insignificant difference in MCV among Al-bushegel group 31.1 ± 0.12fL, Al-falaahat group 30.9 ± 0.92fL, and Al-bualwaan group 31.7 ± 0.35fL, but there's no substantial difference in MCHC between Al-bushegel group 33.1 ± 0.21g/dl, Al-falaahat group 33.4 ± 0.54g/dl, and Al-bualwaan group 32.7 ± 0.40g/dl. When compared to control 35.70 ± 2.42 (U/L), there was no significant difference in ALT activity in Al-bushegel group l 31.16 ± 0.19 (U/L), Al-falaahat group 30.60 ± 0.84 (U/L), and Al-bualwaan group 28.22 ± 1.13 (U/L). Furthermore, as compared to control 86.20 ± 18.79 (U/L), AST activity was substantially higher in Al-bushegel group 46.38 ± 1.32 (U/L), Al-falaahat group 42.11 ± 0.82 (U/L), and Albualwaan group 39.48 ± 1.75 (U/L). In this investigation, serum urea levels were 48.09 ± 0.05, 43.00 ± 0.47 and 51.50 ± 0.89 (mg/dl) in Al-bushegel, Al-falaahat, and Al-bualwaan groups respectively, compared to control levels of 22.35 ± 0.11 mg/dl. In comparison to control 0.71 ± 0.04 (mg/dl), serum creatinine levels increased significantly in Al-bushegel group 1.09 ± 0.01 (mg/dl), Al-falaahat group 1.12 ± 0.06 (mg/dl), and Al-bualwaan group 1.14 ± 0.03 (mg/dl). The affected animal group's heart and respiration rates were significantly ($P \leq 0.05$) higher than those of the control group. In conclusion, it was a considerable difference in Zinc concentrations, haematological, and biochemical characteristics among sheep studied in Fallujah, Iraq.

Keyword: hematological & biochemical parameters, sheep, Zinc deficiency.

Introduction

Zinc was still the second most common trace element in the body, but because it isn't always stored in the body, a continual food intake is necessary for the body's proper metabolic activities (**1**). It was an essential element for ruminants required for a number of metabolic activities. Zn impacted ruminant growth, reproduction, and gene expression, and is necessary for normal immune system function (**2**), Zn is an element of several cellular proteins and acting the main role in gene expression rule and body growth (**3**). It is also important for genetic material and production of protein, glucose metabolic rate, oxygen transport, and cellular membrane stability (**4**). Zn deficiency is produced by lacking quantities of dietary on these elements in foods or hay, and also Zn absorption failure and body stress (**5**). In addition, it acts as an antioxidant, dropping or avoiding oxidative stress. Parakeratosis, anemia, hair loss, late sexual and maturation period, growth retardation, delayed wound healing, and absence of appetite were all signs of Zn deficiency in sheep (**6**), presence of alopecia at the neck, shoulder and abdomen, easily detached wool, rough wool, steely wool and achromotrichia (wool discoloration). Also, there was enlargement of knee joint. Additional signs included inappetence, poor growth, pale

mucous membrane, lameness, staggering gait and diarrhea (**7**). Zinc deficiency is related to a sum of tissue disorders and alterations in normal cell metabolism. Zinc is necessary for the structure and function of many macromolecules, in addition to the responses of above 300 various enzymes. In enzymes, it plays the role of a stimulator and an essential element (**8**). Zinc deficiency, which is essential for bone growth, can lead to decrease in alkaline phosphatase and lactate dehydrogenase activity, change bone calcification, and result in skeleton deformation and joint enlargement in animals (**9**).

Other hormones such GH, thyroid stimulating hormone, luteinizing hormone, follicular stimulating hormone, and adrenocorticotrophic hormone depend on it (**10**). Zinc-containing enzymes had an important role in metabolic and cell reproduction. Furthermore, Zn-containing enzymes like lactate dehydrogenase and carbonic anhydrase are engaged in intermediate metabolism throughout the exercise. In addition, Zn-having enzyme, superoxide dismutase, fights free radical harms**. (11**).

The salivary Zn-reliant polypeptide series directed by the zinc shortage reduced an animal's appetite for food through compromising taste (**12**). The loss of body weight and the pallor of mucous membranes could be seen in zinc deficient animals (**13**). Zn is essential for natural killer and neutrophil cell stimulation and wide obtainability, lymphocyte gene control, T-cell activity, antioxidant capability, cytotoxicity, neuro-transmitters, gene expression, and DNA synthesis, among other things (**14**). This study aimed to detected hematological and biochemical parameters of Zinc deficiency in sheep in Fallujah city**.**

Materials and methods

Study area and design

This study was conducted on 190 Awassi sheep (males) from May 2021 to July 2021, selected randomly from three villages around Fallujah city/Iraq (62 in Al-bushegel, 64 in Al-falaahat and 64 in Al-bualwaan), a different 10 healthy examined sheep, without any signs of illness used as a control group, animals aged 1-3 years with an average weight 38.6 ±0.76 kg. Clinical examination includes recording of temperature, respiration and heart rates, diarrhea, wool status, alopecia, mucous membrane alterations, anemia, loss of appetite and poor growth of all animals. Blood samples were taken for biochemical and hematological examination; this study was carried out from May 2021 to July 2021.

Samples collection

From the jugular vein of each animal, ten milliliters of blood were sampled and put into sterile two types of test tubes, 5 ml in tubes with anticoagulant ethylene diamine tetra acetic acid (EDTA) were kept on an ice pack for hematological parameters, the other 5 ml in tubes without anticoagulant for detecting of liver and kidney enzymes which kept in an

inclined position for 20 minutes then transported on an ice pack to the laboratory, then serum was centrifuged at 3000 rpm for 10 minutes, stored in Eppendorf tubes at (-20ºC) until used for detecting Zn concentration and biochemical analysis by Atomic Absorption Spectrophotometer (15).

Zinc concentration

Zinc levels in serum samples were measured by using an atomic absorption spectrophotometer (UNICAM series 969 UK) at a wavelength of 213.9 nm, so 1 mL of blood was taken and digested in 9 mL of freshly prepared acid mixture 65 % HNO3 and 37 % HCl, which was then gently boiled for 4–5 hours over a water bath (95°C) or until the sample had completely dissolved (16).

Hematological parameters analysis

Hematological analyzer (DXH 560 AL Beckman Coulter, USA) was used to detect blood parameters included the hemoglobin (Hb), red blood cell count (RBCs), mean corpuscular Hb (MCH), mean corpuscular volume (MCV), mean corpuscular Hb concentration (MCHC), packed cell volume (PCV) and white blood cell count (WBCs).

Biochemical parameters analysis

The liver and kidney enzymes (AST, ALT, Urea and Creatinine) were also determined by commercial kits (DiaSys, Germany) and carried out by using Atomic Absorption Spectrophotometer (AAS) UNICAM series 969 UK to estimated photometrically according to instructions of kits manufacturers.

Statistical analysis

SPSS was used for statistical analysis of the data obtained (Version 25). The significance assigned to ($P \leq 0.05$) and the findings were displayed as Mean ± SE. (17).

Results

The current study found a significant reduction ($P \leq 0.05$) in serum Zn concentration (0.21 ± 0.42 ppm in Al-bushegel group, 0.18 ± 0.12 ppm Al-falaahat group and 0.13 ± 0.27 ppm Al-bualwaan group) than the control group 0.67 ± 0.42 ppm as shown in (table 1).

Table (1): Zinc concentration mean values (±SE) in sheep from different villages in Fallujah city.

Parameters	Control group	Al-bushegel	Al-falaahat	Al-bualwaan
Zinc concentration (ppm)	0.67 ± 0.42	0.21 ± 0.42*	0.18 ± 0.12*	0.13 ± 0.27*
* ($P \leq 0.05$) Significant				

Both the control and affected groups had identical average body temperatures, while the heart rates of the afflicted animal group were considerably ($P \leq 0.05$) higher (96.85 ± 0.06 pulse/min in Al-bushegel group, 102.09 ± 0.14 pulse/min in Al-falaahat group and 105.63 ± 0.09 pulse/min in Al-bualwaan group) than those of the control group 78.26 ± 0.34 pulse/min, as well as respiratory rates were considerably ($P \leq 0.05$) higher (39.92 ± 0.10 time/min in Al-bushegel group, 42.04 ± 0.08 time/min in Al-falaahat group and 46.27 ± 0.26 time/min in Al-bualwaan group) than those of the control group 27.52 ± 0.31 time/min, as indicated in (table -2-).

Table (2): Vital signs of examined sheep from different villages in Fallujah city.

Parameters	Control group	Al-bushegel	Al-falaahat	Al-bualwaan
Body temperature (C°)	39.12±0.31	39.35±0.19	38.93±0.33	39.42±0.51
Heart rate (pulse / min)	78.26±0.34	96.85±0.06*	102.09±0.14*	105.63±0.09*
Respiratory rate (time / min)	27.52±0.31	39.92±0.10*	42.04±0.08*	46.27±0.26*
* (P≤0.05) Significant				

According to case history data from this study (table -3-), animals suffered from loss of appetite (38) 61% in Al-bushegel group, (40) 62.8% Al-falaahat group and (44) 68.2% Al-bualwaan group. Alopecia also seen as (18) 28.4% in Al-bushegel group, (17) 26.8% in Al-falaahat group, and (20) 31.7% in Al-bualwaan group. Anemia and pale mucous membranes were (28) 44.6% in Al-bushegel group, (31) 48.2% Al-falaahat group and (34) 53.5% Al-bualwaan group of sheep. Wool loose percentages (43) 68.9% in Al-bushegel group, (46) 71.7% Al-falaahat group and (48) 74.6% in Al-bualwaan group. Diarrhea were (13) 20.4% in Albushegel group, (14) 22.2% Al-falaahat group and (17) 26% Al-bualwaan group. Poor growth (25) 40.7% in Al-bushegel group, (26)41.3% Al-falaahat group and (29) 44.9% in Al-bualwaan group. Parakeratosis (6) 9.5% in Albushegel group, (7) 11.2% Al-falaahat group and (10) 15.9% Al-bualwaan group.

The hematological analysis presented a significant reduction (P≤0.05) in RBCs count (6.88±0.51*10^6/ul in Al-bushegel group, 7.03 ± 0.26*10^6/ul Al-falaahat group and 6.37 ± 0.84* 10^6/ul in Al-bualwaan group) comparative with control 10.25 ± 0.08*10^6/ul, also Hb significantly decreased (7.13±0.22 g/dl in Al-bushegel group, 7.27 ± 0.32 g/dl Al-falaahat group and 6.82 ± 0.43 g/dl in Al-bualwaan group) than control group 9.69 ± 0.18g/dl. Also, PCV significantly decreased (21.41 ± 0.53% in Al-bushegel group, 21.75 ± 0.48% Al-falaahat group and 20.21 ± 0.15% in Al-bualwaan group) than percentage of control group 29.16 ± 0.48% as shown in (table -4-).

Table (3): Clinical signs number and percentages that showed in sheep from different villages in Fallujah city.

Symptoms	Al-bushegel	Al-falaahat	Al-bualwaan
Anemia+ Pale mucous membranes	(28) 44.6%	(31) 48.2%	(34) 53.5%
Diarrhea	(13) 20.4%	(14) 22.2%	(17) 26%
Poor growth	(25) 40.7%	(26) 41.3%	(29) 44.9%
Loss of appetite	(38) 61%	(40) 62.8%	(44) 68.2%
Alopecia	(18) 28.4%	(17) 26.8%	(20) 31.7%
Wool loose	(43) 68.9%	(46) 71.7%	(48) 74.6%
Parakeratosis	(6) 9.5%	(7) 11.2%	(10) 15.9%

On the other hand, the result showed the insignificant difference of MCV (31.1± 0.12 fL in Al-bushegel group, 30.9± 0.92 fL Al-falaahat group and 31.7± 0.35 fL in Al-bualwaan group) than control group 28.4±1.69 fL, with an insignificant difference of MCHC (33.1±0.21g/dl in Al-bushegel group, 33.4±0.54 g/dl Al-falaahat group and 32.7±0.40 g/dl in Al-bualwaan group) of sheep serum that had Zn deficiency symptoms when compared with the control group 33.2±0.71 g/dl which mean it normochromic normocytic anemia as shown in (table -4-).

Table (4): Hematological parameters values in sheep of different villages of Fallujah city. Mean (±SE)

Parameters	Control group	Al-bushegel	Al-falaahat	Al-bualwaan
RBC (10^6/ul)	10.25 ± 0.08	6.88±0.51*	7.03 ± 0.26*	6.37 ± 0.84*
Hb (g/dl)	9.69 ± 0.18	7.13±0.22*	7.27 ± 0.32*	6.82 ± 0.43*
PCV (%)	29.16 ± 0.48	21.41 ± 0.53*	21.75 ± 0.48*	20.21 ± 0.15*
WBC (10^3/ul)	7.90±0.30	10.48 ± 0.74	11.03 ± 0.96	10.83 ± 0.69
MCV (fL)	28.4±1.69	31.1± 0.12	30.9± 0.92	31.7± 0.35
MCH (pg)	9.5± 0.05	10.4± 0.60	10.3± 0.20	10.7± 0.49
MCHC (g/dl)	33.2±0.71	33.1±0.21*	33.4±0.54*	32.7±0.40*
* ($P \leq 0.05$) Significant				

In this study ALT activity was not significant variation in Al-bushegel group 31.16 ± 0.19 (U/L), Al-falaahat group 30.60 ± 0.84 (U/L), and Al-bualwaan group 28.22 ± 1.13 (U/L) when compared to control 35.70±2.42 (U/L). Moreover, AST activity was significant raised in Al-bushegel group 46.38 ± 1.32 (U/L), Al-falaahat group 42.11 ± 0.82 (U/L) and Albualwaan group 39.48 ± 1.75 (U/L) compared to control 86.20±18.79 (U/L) as shown in (table -5-).

Serum urea results in this study were a significant in studied areas 48.09 ± 0.05, 43.00 ± 0.47 and 51.50 ± 0.89 (mg/dl) in Al-bushegel, Al-falaahat, and Al-bualwaan groups respectively, compared to control 22.35±0.11 mg/dl. While serum creatinine level exhibited a significant increase in Al-bushegel group 1.09 ± 0.01(mg/dl), Al-falaahat group 1.12 ± 0.06(mg/dl) and Al-bualwaan group 1.14 ± 0.03(mg/dl) related to control 0.71±0.04(mg/dl) as shown in (table -5-).

Table (5): Biochemical parameters values in sheep from different villages in Fallujah city. Mean (±SE)

Parameters	Control group	Al-bushegel	Al-falaahat	Al-bualwaan
ALT (U/L)	35.70±2.42	31.16 ± 0.19	30.60 ± 0.84	28.22 ± 1.13
AST (U/L)	86.20±18.79	46.38 ± 1.32*	42.11 ± 0.82*	39.48 ± 1.75*
Urea (mg/dl)	22.35±0.11	48.09 ± 0.05*	43.00 ± 0.47*	51.50 ± 0.89*
Creatinine (mg/dl)	0.71±0.04	1.09 ± 0.01*	1.12 ± 0.06*	1.14 ± 0.03*
* (P≤0.05) Significant				

Discussion

The present study results agree with (**18**) who noticed that Zn level (in sheep in Al-Najaf province) was 0.190±0.007 ppm, and (**19**) who found serum value of Zn in sheep was 31.25 ± 5.43 μg/dl [0.312± 5.43 ppm], also (**20**) who noticed that serum Zn concentration was 7.61±0.28 μmol/L [0.497±0.28 ppm]. (**21**) found 44.13±3.16 ug/dl [0.441±3.16 ppm] in blood, and (**22**) who recorded 4.51 ± 0.13 μmol/L [0.294± 0.13 ppm] in blood of affected sheep. While (**23**), (**24**) were found Zn concentration 0.11 ± 0.02 ppm and 0.117 mg/dl [0.0117 ppm] respectively.

The present study results disagree with (**25**) who found the serum concentrations of Zn were 0.652±0.021, 0.686±0.020, 0.65±0.26, 0.72± 0.010 ppm, and with (**26**) who recorded Zinc values 82.85±3.2, 80.96±2.71, 85.88±2.76 μg/dl [0.828±3.2, 0.809±2.71, 0.858±2.76 ppm]. Also (**27**) who found 8.34 ± 1.07μmol/l [0.545 ppm], (**28**) noticed that Zn level was 8.63±2.22μmol/L [56.44 ug/dL, 0.564 ppm]. In addition, (**29**), (**30**), (**31**) and (**32**) were recorded Zn concentration (0.70 μg/mL, 0.19 μg/mL) [0.70 ppm, 0.19 ppm], [0.69±0.06 ppm], 173.02± 2.814μg/dl [1.730 ppm], and [1.13±0.07 ppm].

The current study found Zn deficiency resulted in physiological defects accompanied by a wide range of disorders, such as loss of appetite, wool loss, growth retardation, anemia and pale mucous membranes, alopecia, and diarrhea; which was consistent with (**33**) findings. This conclusion corroborated results, that linked the disruption to a reduction in Zn-dependent metabolic enzymes such as alkaline phosphatase, also many soils are zinc deficient, and fertilizers could increase crop yields and grain Zn levels, thereby increasing Zn in the food supply and alleviating animals' Zn deficiency (**22**).

The current results were with agreement of (**26**) who found animals body temperature 39.74 ± 0.19 °C, 39.20 ± 0.03 °C, 39.18 ± 0.09 °C. Also (**25**) detected an increase in Pulse rate 75.6±12.07 pulse/min and Respiratory rate 32.73±1.35 time/min. In addition, the body temperature 39.37 ± 0. 28 °C, Heart Rate 101.6 ± 4.6 pulse/min, Respiratory Rate 41 ± 3.1 time/min noticed by (**19**). Body temperature 38.62±0.12 °C, Heart Rate 123.9±5.33 pulse/min, Respiratory Rate 30.40±1.68 time/min were recorded by (**20**). Also (**32**) found The mean of body temperature was (39.46±0.04 °C) similar in both control and mineral deficiency group, While the means of respiratory and pulse rate were 34.15 ±4.68 time/min, 87.17±0.57 pulse/min respectively.

The present study found that a considerable rise (P<0.05) in pulse and respiratory rates happened as a compensatory means against anemic hypoxia, for the reason that the reduction in the RBCs amount and Hb levels affected the oxygen spread to tissues, so a failure of tissues to receive enough quantity of

oxygen will take place and such explanation was in agreement with those of (**34**).

The results of current study with the agreement of (**25**) who found anemia and pale mucous membranes was 54.8%, alopecia and steely wool 32.4%, diarrhea7.2%, pica 6%, parakeratosis 1.2%, while (**18**) recorded anemia 40.6%, wool lose 87.5%, diarrhea 28.1%, loss of appetite 87.5%, poor growth 40.6%, parakeratosis 56.2%, also (**19**) found icterus of mucous membranes 45 (75%), wool loss 41 (68.5%), diarrhea 14 (23.3%), loss of appetite 38 (63.3%), alopecia 16 (26.5%), parakeratosis7 (11.5%), pica 20 (33.5%).

This study agree with (**25**) who found RBCs count was 5.40 ± 0.13, 5.16 ± 0.14, 5.33 ± 0.12, $5.04\pm0.11(10^6/ul)$, and with (**19**) who recorded $6.8\pm1.42(10^6/ul)$, while (**26**) noticed that RBCs count were 7.42 ± 0.22, 7.77 ± 0.20, $7.98\pm0.10(10^6/ul)$, and (**32**) who found it 6.42 ± 0.14 $(10^6/ul)$, also (**35**) found RBCs count 8.636 ± 2.484 $(10^6/ul)$. But the study disagreed with (**20**) who found RBCs count $12.54\pm0.55(10^6/ul)$, and (**22**) who recorded RBCs count $9.87\pm1.59(10^6/ul)$.

This study agree with (**25**) who recorded the Hb 7.12 ± 0.15, 7.08 ± 0.18, 7.20 ± 0.15, $6.50\pm0.15(g/dl)$. Also, (**19**) found Hb $7.66\pm1.03(g/dl)$, and (**13**) who noticed that Hb was $5.96\pm0.19(g/dl)$, also (**26**) found Hb values 7.42 ± 0.23, 8.32 ± 0.23, $7.91\pm0.17(g/dl)$. (**32**) found Hb $6.76\pm0.14(g/dl)$.

The current study agree with (**25**) who recorded PCV $21.00\pm0.45\%$, $21.16\pm0.55\%$, $21.35\pm0.48\%$, and $19.14\pm0.43\%$. Also (**19**) found PCV was $24.3\pm3.05\%$, and (**26**) who found PCV percentages $22.44\pm0.58\%$, $24.10\pm0.65\%$, and $24.98\pm0.50\%$. PCV/ (%) 28.85 ± 2.37 (**22**). while (**32**) found PCV percentages was $19.94\pm0.36\%$ and (20) who noticed that PCV was $17.75\pm0.55\%$,

MCV values in this study agree with (**19**) who recorded MCV $35.7\pm2.82(fL)$, and (**26**) who found MCV 30.46 ± 0.69, 31.17 ± 1.20, $31.34\pm0.50(fL)$, (**32**) found $31.99\pm0.72(fL)$, MCV 29.59 ± 3.54 (fL) (**22**) also (**35**) found MCV $43.39\pm8.186(fL)$. but this study disagree with (**13**) who noticed that MCV was $14.64\pm0.74(fL)$.

This study agree with (**19**) who found MCHC $33.41\pm3.65(g/dl)$, and (**20**) who noticed MCHC $33.59\pm.0.38(g/dl)$, also (**26**) found MCHC 33.51 ± 0.64, 34.53 ± 0.84, $33.35\pm0.87(g/dl)$. also (**32**) found MCHC was $33.8\pm0.49(g/dl)$. MCHC $33.84\pm2.16(g/dl)$ (**22**)

The current study agree with (**26**) who recorded WBC 12.33 ± 0.96, 9.13 ± 1.19, $10.23\pm0.42(10^3/ul)$, and (**35**) who found WBC 9.395 ± 4.418 $(10^3/ul)$, WBC $9.76\pm1.37(10^3/ul)$ (34), but the study disagreement with (**25**) who found WBC was 6.44 ± 0.37, 6.21 ± 0.27, 5.94 ± 0.23, 6.09 ± 0.39 $(10^3/ul)$, and (**20**) who noticed that WBCs $5.82\pm9.32(10^3/ul)$.

The study found a significant $(P<0.05)$ reduction in hematological values due to a decrease in Zn level, that interfere with RBCs synthesis. Also, an increase in lipid peroxidation and oxidative stress caused an increase in the creation of free radicals, which lead to bone marrow depression and a drop in haematological results, causing an erythropoietin decline, which was supported by (**36**).

The current study agree with (**26**) who found ALT 19.60 ± 0.84, 19.22 ± 1.13, $29.58\pm1.48(U/L)$, AST 27.17 ± 0.82, 26.48 ± 1.75, $37.37\pm1.48(U/L)$, and (**22**) who found ALT $38.67\pm2.26(U/L)$, AST $53.45\pm11.34(U/L)$. The current study disagreed with (**35**) who found ALT 31.19 ± 21.50 (U/L), AST 54.16 ± 728.9 (U/L).

The results in this study was agreed with (**26**) who recorded Urea 53.00 ± 4.47, 39.50 ± 1.89, $53.48\pm3.16(mg/dl)$, and Creatinine 1.12 ± 0.06, 0.84 ± 0.03, $1.16\pm0.04(mg/dl)$. Also (**7**) who found Urea (mg/dl) $48.58*\pm3.16$.

The results in this study was disagreed with (**35**) who found Urea 1.478 ± 22.10 (mg/dl) and Creatinine was 1.259 ± 65.23 (mg/dl).

The present study revealed that free radicals which generated during the metabolic attack of the poison in the smooth endoplasmic reticulum of the liver cell and are chemically related to the poison itself, produced damage to the liver and kidneys, causing biochemical changes that lead to lower body weight, loss of wool, and easily obvious zinc lacks, which was supported up by (**37**).

Conclusion

Between healthy and emaciated sheep, significant alterations in serum zinc levels, biochemical, and hematologic analyses were revealed in the current study. The establishment of reference ranges for sheep is assisted by the normal values of the studied parameters. Furthermore, the noticed changes could help as beneficial pointers intended for early recognition and valuing the health status of diseased sheep.

References

1- Zalewski, P. D., Truong-Tran, A. Q., Grosser, D., Jayaram, L., Murgia, C., & Ruffin, R. E. (2005). Zinc metabolism in airway epithelium and airway inflammation: basic mechanisms and clinical targets. A review. Pharmacology & therapeutics, 105(2), 127-149.

2- Tsai, Y. H., Mao, S. Y., Li, M. Z., Huang, J. T., & Lien, T. F. (2016). Effects of nanosize zinc oxide on zinc retention, eggshell quality, immune response and serum parameters of aged laying hens. *Animal feed science and technology*, *213*, 99-107.

3- Song, C., Gan, S., He, J. and Shen, X. (2021). Effects of nano-zinc on immune function in qianbei-pockmarked goats. Biol. Trace Elem. Res., 199(2): 578-584.

4- O'Dell, B. L. (2000). Role of Zinc in Plasma Membrane Function. The Journal of Nutrition, 130: 1432-1436.

5- Alhaji, N.B. and Musa, I.G. (2012). Zinc Deficiency (Hypozincemia) in a Lamb: Clinical Field Case IJAVMS, Vol. 6, Issue 5; 349-352.

6- Rikaby, A. A. (2013). *The protective effects of Ethanolic Extract of Ginger and co-enzyme Q10 against Cadmium Induce Toxicity in Rabbit* (Doctoral dissertation, Thesis of PhD, Basra University. Basra, Iraq).

7- Abd El-Raof, Y. M., & Ghanem, M. M. (2006). Clinical and haemato-biochemical studies on cases of alopecia in sheep due to deficiency of some trace elements. *SCVMJ, X (1)*, 17-27.

8- Gudrun R, Toborck M, Henning B. (2004). Peroxisone proliferator activated recceptors γ require zinc for their ananti-inflammatory properties in porcine vascular endothelial cells. J. Nutr. 134:1711–1715.

9- Pang QH, Zhang L, Zhang CY, Yang XH, Lu JY. (2002). Advances of the zinc research in the health and nutrition of animals. Progress Vet Med 2:41–43.

10- Alves, C.X., S.H. Vale, M.M. Dantas, A.A. Maia and M.C. Franca *et al*., (2012). Positive effects of zinc supplementation on growth, GH, IGF1 and IGFBP3 in eutrophic children. J. Pediatr. Endocrinol. Metab., 25: 881-887.

11- Kavas, G.O., Ayral, P.A. and Elhan, A.H. (2013). The effects of resveratrol on oxidant/antioxidant systems and their cofactors in rats. Adv. Clin. Exp. Med., 22: 151-155.

12- Suzuki, H., A. Asakawa, J.B. Li, M. Tsai and H. Amitani *et al*., (2011). Zinc as an appetite stimulator-the possible role of zinc in the progression of diseases such as cachexia and sarcopenia. Recent Pat. Food Nutr. Agric., 3: 226-231.

13- Al-Saad, K. M., Al-Sadi, H. I., & Abdul-Majeed, M. O. (2010). Clinical, hematological, biochemical and pathological studies on zinc deficiency (hypozincemia) in sheep. *Veterinary Research (Pakistan)*, *3*(2), 14-20.

14- Fouda, T. A., Youssef, M. A., & El-Deeb, W. M. (2011). Correlation between zinc deficiency and immune status of sheep. *Veterinary Research (Pakistan)*, *4*(2), 50-55.

15- Ozdemir, I., Şahin, M., Orhan, R., & Erdem, M. (2014). Preparation and characterization of activated carbon from grape stalk by zinc chloride activation. *Fuel processing technology*, *125*, 200-206.

16- Ang, H. H., & Lee, K. L. (2005). Analysis of mercury in Malaysian herbal preparations

17- SAS. (2012). Statistical Analysis System, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.

18- Hatem, Abdulameer Abed; Abdul wahid, Nabeel Ahmed. (2015). Field and laboratory study of trace elements deficiency in sheep in Al-Najaf province. Kufa Journal for Veterinary Medical Sciences. Vol. 6, No. 2;49-55.

19- Naji, Hussein Ali. (2017). THE EFFECT OF ZINC AND COPPER DEFICIENCY ON HEMATOLOGICAL PARAMETERS, OXIDATIVE STRESS AND

ANTIOXIDANTS LEVELS IN THE SHEEP. Bas. J. Vet. Res. Vol. 16, No.2;344-355.

20- Al-Zubaedi, Raad Mahmood; Mahmood, Alaa Kamil and Al-Khafaji Nazar Jabbar. (2019). Study of the Experimentally Induced Zinc Deficiency in Iraqi Local Breed Goats. The Iraqi Journal of Veterinary Medicine, 43 (2): 46-55.

21- El-Far, A. H. (2013). Biochemical alterations in zinc deficient sheep associated by hyperlactatemia. *American Journal of Animal and Veterinary Sciences*, *8*(3), 112.

22- Song, C., & Shen, X. (2020). Effects of environmental zinc deficiency on antioxidant system function in Wumeng semi-fine wool sheep. *Biological trace element research*, *195*(1), 110-116.

23- Ibrahim, S. O., Helal, M. A., Abd El Raof, Y. M., & Elattar, H. M. (2016). Experimental study on zinc deficiency in sheep. *Benha Vet. Med. J*, *31*(1), 110-118.

24- Olmedo-Juáreza, A. Rojoa, R. Salemb, A.Z.M. Vázquez-Armijoa, J.F. Rebollar-Rebollara, S. Albarrana, B. and Lugo, J. (2012). CONCENTRATION OF SOME ELEMENTS IN BLOOD SERUM OF NONLACTATING GOATS IN A SUBTROPICAL REGION OF SOUTHWEST jjOF MÉXICO STATE. Tropical and Subtropical Agroecosystems, 15: 71-75.

25- Mohammed, I. A.; Gadi, J. A.; Al–Amery, M.A.Y. (2013). Study of some minerals deficiency in grazing sheep in Thi-Qar province. AL-Qadisiya Journal of Vet. Med. Sci. Vol. 12, No.1;106-112.

26- GALBAT, S.A.; ABDALLAH, A.M.; MAHMOUD, M.A. AND EL-ZEFTAWY, MARWA. (2021). CLINICAL STUDY ON THE IMPACT OF NUTRITIONAL DEFICIENCY ON THE HEALTH STATUS OF THE SHEEP IN NEW VALLEY GOVERNORATE. Assiut Veterinary Medical Journal. Vol. 67 No. 171; 143-157.

27- Zavoshti, F. R., Rezaei, S. A., Sioofy-Khojine, A. B., & Heidary, A. A. (2012). Correlation of zinc and copper values in the blood serum of Makuii sheep. *Comparative Clinical Pathology*, *21*(6), 1263-1267.

28- Silva, T. R., Soares, P. C., Dantas, A. F., Marques, A. V., O Filho, E. F., Aguiar, G. M. N., ... & Riet-Correa, F. (2018). Serum and liver copper, iron, molybdenum and zinc concentration in goats and sheep in the state of Paraíba, Brazil. *Pesquisa Veterinária Brasileira*, *38*, 1313-1316.

29- Page, C. M., Murphy, T. W., Van Emon, M. L., Bowman, J. G. P., Wyffels, S. A., & Stewart, W. C. (2018). Blood serum mineral element concentrations of weaned Montana ram lambs and their relationship with water quality characteristics. *The Professional Animal Scientist*, *34*(5), 410-420.

30- Herdt, T. H., & Hoff, B. (2011). The use of blood analysis to evaluate trace mineral status in ruminant livestock. *Veterinary Clinics: Food Animal Practice*, *27*(2), 255-283.

31- Autukaitė, J., Poškienė, I., Juozaitienė, V., Undzėnaitė, R., Antanaitis, R., & Žilinskas, H. (2020). Inf luence of season and breed on serum mineral levels in sheep. *Polish Journal of Veterinary Sciences*, 473-476.

32- Saleh, W. M. M. (2019). Clinical and hematological profiles due to cases of minerals deficiency in local ewes at Basra, Iraq. *Adv. Anim. Vet. Sci*, *7*(4), 315-320.

33- Sloup, V., Jankovská, I., Nechybová, S., Peřinková, P., & Langrová, I. (2017). Zinc in the animal organism: a review. *Scientia Agriculturae Bohemica*, *48*(1), 13-21.

34- Naji, H. A. (2017). The effect of zinc and copper deficiency on hematological parameters, oxidative stress and antioxidants levels in the sheep. *Basra J. Vet. Res*, *16*(2), 344-355.

35- Wang, H., Huang, M., Li, S., Wang, S., Dong, S., Cui, D., ... & Liu, Y. (2015). Hematologic, serum biochemical parameters, fatty acid and amino acid of Longissimus dorsi muscles in meat quality of Tibetan sheep. *Acta Scientiae Veterinariae*, *43*, 1306.

36- Schalm, O. W., Jain, N. C., & Carroll, E. J. (1975). *Veterinary hematology* (No. 3rd edition). Lea & Febiger. Philadlphia pp. 44, 349. 604-608.

37- Jemai, H., Messaoudi, I., Chaouch, A., & Kerkeni, A. (2007). Protective effect of zinc supplementation on blood antioxidant defense system in rats exposed to cadmium. *Journal of Trace Elements in Medicine and Biology*, *21*(4), 269-273.