

Biochemical blood parameters and oxidative indices of broiler blood affected by locally extracted aloe vera oil in different ways

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Abstract:

The study consisted of two parts: the first was conducted at the Al-Baz hatchery in the holy city of Karbala on October 30, 2025 (18 day of incubation). The second part was conducted at the poultry farm, Agricultural Research and Experiment Station, College of Agriculture, Al-Muthanna University, from November 2, 2025, to December 7, 2025, for a period of 35 days. Two hundred and seventy one-day-old, unsexed Ross 308 broiler chicks, 40 gm weight each, were used in the study. The chicks were raised in a 40×10 m hall. They were housed in four-tiered batteries, each tier containing a 1×1.5 m cage. The chicks were randomly distributed into six experimental treatments, with 45 chicks per treatment. Each treatment had three replicates (15 chicks per replicate). The experimental treatments were as follows: T1: Negative control (no injection). T2: Positive control (In ovo injection of hatching eggs with 0.01 ml of sterile distilled water). T3: In ovo injection of hatching eggs with 0.01 ml of locally extracted aloe vera oil. T4: Oral administration of 0.25 ml/chick of locally extracted aloe vera oil to seven-day-old chicks. T5: Add of 2 ml/liter of locally extracted aloe vera oil to drinking water. T6: Add of 4 ml/kg of feed to locally extracted aloe vera oil. The results showed that a significant decrease ($P \leq 0.05$) on some blood biochemical parameters, namely cholesterol, triglycerides, and glucose concentrations. Conversely, a significant increase ($P \leq 0.05$) on albumin, globulin, and total protein concentrations in all treatments administered locally extracted aloe vera oil compared to the control treatments. The best results were obtained in treatment T5. Regarding oxidation, a significant decrease ($P \leq 0.05$) on the concentration of malondialdehyde. Conversely, a significant increase ($P \leq 0.05$) on the concentrations of both glutathione

peroxidase and catalase enzyme in all treatments administered locally extracted aloe vera oil compared to the two control treatments.

Keywords: Biochemical blood, oxidative indices, broiler blood, locally extracted, aloe vera oil, different ways.

Introduction:

Nutrition is the most important factor in determining production performance and the economic viability of poultry farming projects. Therefore, many recent studies have focused on innovative feeding strategies, specifically, adding feed supplements to poultry rations to improve their overall production performance [1]

These nutritional supplements have proven highly effective in strengthening the immune system, altering the gut microbiome, and maintaining digestive health, leading to a significant increase in poultry productivity. Researchers are currently exploring safe and natural plant-based alternatives that can be used as poultry supplements, further enhancing their productivity [2], [3]

Aloe vera leaves, whether used directly or in powder or extract form, can positively affect poultry production performance. Adding aloe vera water extract to drinking water leads to a significant increase in blood hemoglobin concentration, as

well as red and white blood cell counts [4]

The results showed that broiler chickens with added aloe vera gel powder showed a significant increase in the number of red and white blood cells, lymphocytes, and packed cell volume compared to other treatments [5]

A study by [6] on the effect of aloe vera powder and its aqueous extract on the immunity of broiler chickens after 42 days showed a significant improvement in the studied parameters after adding the plant extract at different concentrations: 0.075, 0.10, and 0.125%, highly statistically significant differences were found in the ratio of heterozygous lymphocytes (H/L).

As for [7], they added an aqueous extract of aloe vera to the diets of Ross 308 hybrid broiler chickens at three concentrations: 5, 15, and 30 ml/L, once to the basal feed and once to the drinking water. The results showed that when 30 ml/L of the aqueous extract of aloe vera was added to the feed, there was a significant improvement in white and red blood cell counts, hemoglobin

concentration, packed cell volume, and serum immunoglobulin concentration.

A study by [4] showed that adding an aqueous extract of aloe vera to drinking water resulted in a significant increase in blood hemoglobin concentration, as well as red and white blood cell counts, compared to the control treatment.

Injecting 0.1 ml of extracts from medicinal plants (cinnamon, clove, aloe vera, and thyme) into chicken hatching eggs on the tenth day of incubation, resulted in a significant increase in total protein, immunoglobulin, total triglycerides, and high-density lipoprotein (HDL) concentrations. Meanwhile, the injections led to a significant decrease in blood cholesterol and low-density lipoprotein (LDL) levels in broiler chickens [8].

[9] stated that treating feed rations with concentrations of (0.3 and 0.4) ml of oil/kg of feed from local and imported aqueous and alcoholic extracts showed a significant improvement in some blood parameters, which included (the concentration of albumin, globulin and total protein in blood plasma), as well as a significant improvement in the concentration of antioxidants (Malondialdehyde, Glutathione and Catalase).

[10] conducted a study examining the effect of injecting hatching eggs with aqueous and alcoholic extracts of aloe vera. The treatments showed a significant improvement in several blood biochemical indicators, including increased concentrations of albumin, globulin, and total protein, reflecting an enhancement of plasma protein and functional status. A significant improvement was also observed in antioxidant indicators, specifically glutathione (GSH) and catalase (CAT), demonstrating the effective role of aloe vera compounds in reducing oxidative stress and supporting cellular homeostasis.

This study aims to demonstrate the effect of different methods of using locally extracted aloe vera oil on some biochemical blood parameters and oxidation indices in broiler blood.

Materials and Methods:

The study consisted of two parts: the first was conducted at the Al-Baz hatchery in the holy city of Karbala on October 30, 2025. The second part was conducted at the poultry farm, Agricultural Research and Experiment Station, College of Agriculture, Al-Muthanna University, from November 2, 2025, to December 7, 2025, for a period of 35 days. The aim was to determine the

effect of administering locally extracted aloe vera leaf oil on certain productive, immunological, and physiological characteristics of broiler. Two hundred and seventy one-day-old, unsexed Ross 308 broiler chicks, 40 gm weight each, were used in the study. The chicks were raised in a 40×10 m hall. They were housed in four-tiered batteries, each tier containing a 1×1.5 m cage. The chicks were randomly distributed into six experimental treatments, with 45 chicks per treatment. Each treatment had three replicates (15 chicks per replicate). The experimental treatments were as follows:

T1: Negative control (no injection).

T2: Positive control (In ovo injection of hatching eggs with 0.01 ml of sterile distilled water).

T3: In ovo injection of hatching eggs with 0.01 ml of locally extracted aloe vera oil.

T4: Oral administration of 0.25 ml/chick of locally extracted aloe vera oil to seven-day-old chicks.

T5: Add of 2 ml/liter of locally extracted aloe vera oil to drinking water.

T6: Add of 4 ml/kg of feed to locally extracted aloe vera oil.

Aloe vera leaves were obtained from local markets in Al-Muthanna Governorate. The leaves were then thoroughly washed with running water to remove any dirt. They were dried completely and stored in a cool, dry place to prevent spoilage. The leaves were then cut into small pieces. These pieces were placed in polyethylene bags. They were then refrigerated at 5 degrees Celsius until the oil extraction process could be carried out.

The aloe vera oil extraction process was carried out using a water bath according to the method of [11]. Aloe vera leaf pieces were placed in a glass flask with a quantity of vegetable oil. The small pieces of aloe vera were submerged in the oil. The glass flask was then tightly sealed. It was placed in a water bath at 60°C for one hour. Afterward, it was left at room temperature for half an hour. It was then placed in a refrigerator at 5°C for one hour to facilitate the separation of the oil from the water. Finally, it was placed in a centrifuge at 2000 rpm for five minutes. The oil was then placed in special containers and stored in a cool, dry place until use.

Results and Discussion:

Table (1) shows the effect of adding locally extracted aloe vera oil on the concentration of

cholesterol, triglycerides, and glucose in broiler blood serum. The results indicate significant differences ($P \leq 0.05$) between the treatments. Regarding serum cholesterol concentration, the results showed significant differences ($P \leq 0.05$) between the treatments. T5 recorded the lowest cholesterol concentration ($P \leq 0.05$) compared to all experimental treatments, reaching 234.28 mg/100 ml. Treatments T6 and T4 followed, with no significant differences between them. Meanwhile, the negative control (T1) and positive control (T2) treatments recorded the highest cholesterol concentrations, at 256.16 and 250.25 mg/100 ml, respectively.

While cholesterol concentration decreased significantly in the treatments that included aloe vera oil, particularly in treatment T5, regarding triglyceride concentration, the results showed

significant differences ($P \leq 0.05$) between all treatments. Control treatments T1 and T2 recorded the highest triglyceride concentrations at 158.17 and 154.65 mg/100 ml, respectively. T5 recorded the lowest concentration at 139.94 mg/100 ml, followed by T6. T4 and T3 recorded intermediate values compared to the control treatment.

Regarding serum glucose concentration, the results showed significant differences ($P \leq 0.05$) between all treatments. T5 recorded the lowest value at 184.22 mg/100 ml, followed by T6 and T4. T3 recorded a relatively higher value compared to the other treatments that included aloe vera oil. Meanwhile, the control treatments T1 and T2 recorded the highest glucose concentrations at 208.04 and 201.11 mg/100 ml, respectively.

Table (1) Effect of using locally extracted aloe vera oil on the concentration of cholesterol, triglycerides and glucose in broiler blood serum $\pm$ standard error.

Treatments	Cholesterol (mg/ 100 ml)	Triglycerides (mg/ 100 ml)	Glucose (mg/ 100 ml)
T1	$\pm$ 256.16	$\pm$ 158.17	$\pm$ 208.04
	1.21	0.46	0.83
	a	a	a
T2	$\pm$ 250.25	$\pm$ 154.65	$\pm$ 201.11
	1.20	0.43	0.36
	b	b	b

	±	246.26	±	150.99	±	197.87
T3		0.52		0.66		1.17
	c		c		c	
	±	240.88	±	148.03	±	194.97
T4		0.83		0.45		1.15
	d		d		d	
	±	234.28	±	139.94	±	184.22
T5		0.66		0.32		0.93
	e		f		f	
	±	239.71	±	143.70	±	190.98
T6		0.83		0.50		0.15
	d		e		e	
Sig.	*		*		*	

Table (1) shows the significant decrease in serum cholesterol levels resulting from the effect of locally extracted aloe vera leaf oil. This is attributed to the ability of the active compounds in these leaves to influence lipid metabolism and regulate blood lipoprotein levels, particularly high-density lipoprotein (HDL). This aligns with the findings of [12] regarding the use of an aqueous extract of aloe vera gel, which also contributed to lowering serum cholesterol levels.

A significant decrease in serum triglyceride concentration was observed in the locally extracted aloe vera oil treatments compared to the control treatments. This decrease may be attributed to the presence of several active compounds in aloe vera leaves, most notably acemannan, which plays a significant role in regulating lipid metabolism and reducing its accumulation in the blood.

Furthermore, it improves metabolic processes related to lipid metabolism. These results are consistent with those of [13], who indicated that adding aloe vera gel extract contributed to reducing serum triglyceride concentration in broiler. This is attributed to the role of the plant's bioactive compounds in regulating lipid metabolism. The significant decrease in serum triglyceride concentration in experimental birds, affected by the aloe vera leaf oil treatments compared to the negative and positive control treatments.

This may be attributed to the effect of the active compounds found in aloe vera leaves, particularly aloin and flavonoids, which possess antioxidant properties that contribute to inhibiting lipid oxidation and regulating its metabolism, resulting in a reduction of serum triglyceride levels [14], [15], [16].

The same table shows that the blood glucose concentration in the experimental birds' blood serum, was affected by the locally extracted aloe vera leaf oil treatments compared to the positive and negative control treatments. This may be attributed to the presence of active compounds in aloe vera that can stimulate insulin activity in pancreatic beta (β) cells [17]. This effect may also be due to the presence of essential amino acids in aloe vera leaves, which may act synergistically or individually to stimulate pancreatic beta (β) cells to secrete insulin. Furthermore, this may be explained by aloe vera's ability to increase the sensitivity of insulin-secreting beta cells, in addition to its role in reducing damage to these cells and contributing to the restoration of activity in partially damaged cells, thus stimulating insulin secretion [18], [19].

This effect may also be related to the presence of unsaturated fatty acids in aloe vera leaves, particularly oleic acid. [20] indicated that this acid plays an important role in regulating blood glucose levels, especially when insulin activity is low, as well as contributing to reducing lipid disorders associated with low blood sugar.

Table (2) shows the effect of adding locally extracted aloe vera oil on the concentration of protein, albumin,

and globulin in broiler blood serum. The results indicate significant differences ($P \leq 0.05$) between all treatments. Regarding total serum protein concentration, the results showed significant differences ($P \leq 0.05$) between all treatments. Treatment T5 recorded the highest protein concentration compared to the other treatments, reaching 4.87 gm/100 ml, followed by treatment T6 with a value of 4.58 gm/100 ml. Meanwhile, the negative control (T1) and positive control (T2) treatments recorded the lowest values compared to the other treatments, at 3.61 and 3.94 gm/100 ml, respectively.

Regarding albumin concentration, the results showed significant differences ($P \leq 0.05$) between all treatments. Treatment T5 recorded the highest albumin concentration at 2.61 gm/100 ml, followed by treatment T6 at 2.44 gm/100 ml. Meanwhile, albumin concentration was significantly lower in the control treatments T1 and T2 compared to the other treatments, at 1.91 and 2.03 gm/100 ml, respectively.

Regarding serum globulin concentration, the results showed significant differences ($P \leq 0.05$) between the treatments. Treatment T5 recorded the highest globulin concentration at 2.29 g/100 ml, followed by treatments T6 and T4, between which no significant differences were found. Meanwhile,

the control treatments T1 and T2 recorded the lowest values at 1.71 and 1.91 g/100 ml, respectively.

Table (2) shows a significant increase in the serum concentrations of total protein, albumin, and globulin in experimental birds treated with locally extracted aloe vera leaf oil. These concentrations were superior to the control group. This significant increase may be attributed to the presence of several active compounds in aloe vera leaves, particularly aloin and emodin, which contribute to

improving these concentrations. This may also be due to an improvement in the microbial balance of beneficial microorganisms in the intestines, which secrete digestive enzymes that enhance the activity of naturally occurring digestive enzymes in the digestive tract. Among the most important of these are peptidase and proteinase, which play a crucial role in breaking down large protein molecules into amino acids that are easily absorbed by the body. This is reflected in the increased serum protein concentration [21]

Table (2) Effect of methods of adding locally extracted aloe vera oil on the concentration of protein, albumin, and globulin in broiler blood serum $\pm$ standard error.

Treatments	Protein (gm/ 100 ml)	Albumin (gm/ 100 ml)	Globulin (gm/ 100 ml)
T1	0.04 $\pm$ 3.61 f	0.02 $\pm$ 1.91 f	0.01 $\pm$ 1.71 e
T2	0.04 $\pm$ 3.94 e	0.01 $\pm$ 2.03 e	0.03 $\pm$ 1.91 d
T3	0.01 $\pm$ 4.16 d	0.01 $\pm$ 2.14 d	0.01 $\pm$ 2.03 c
T4	0.05 $\pm$ 4.40 c	0.03 $\pm$ 2.25 c	0.02 $\pm$ 2.15 b
T5	0.04 $\pm$ 4.87 a	0.01 $\pm$ 2.61 a	0.02 $\pm$ 2.29 a
T6	0.04 $\pm$ 4.58 b	0.01 $\pm$ 2.44 b	0.01 $\pm$ 2.17 b
Sig.	*	*	*

Similarly, the significant improvement in blood parameters in experimental birds may be attributed to the presence of bioactive compounds in aloe vera leaves. These compounds contribute to improved digestion and enhanced secretion of digestive enzymes such as pepsin and trypsin. These leaves also contain numerous amino acids, such as aspartic acid, cysteine, glycine, tryptophan, valine, and proline, which contribute to the activation of insulin secretion. Insulin, in turn, stimulates the conversion of amino acids into protein within cells. Furthermore, the increase in albumin and globulin concentrations in the oil extracted from aloe vera leaves, may be due to an enhanced immune response in the birds [22]

[23] indicated that the improvement in blood parameters, may be attributed to the active compounds in aloe vera leaves, particularly aloin and emodin, as the synergistic effect of these two compounds plays a significant role in enhancing the bird's health, which positively impacts the process of blood cell formation, a key indicator of the bird's overall health. In addition to what was mentioned in the study by [4], which showed that the active compounds found in aloe vera leaves possess a high capacity to reduce oxidative degradation, this contributes to increasing blood proteins by enhancing amino acid transport in the liver. These

compounds also possess antioxidant properties, neutralizing free radicals and inhibiting their harmful effects that can lead to protein breakdown in blood plasma. This positively impacts the improvement of blood protein parameters. These results support the findings of our current experiment, which showed a significant increase in total protein, albumin, and globulin concentrations in the aloe vera leaf oil treatments compared to the control treatment.

Table (3) shows the effect of adding locally extracted aloe vera oil on the concentration of malondialdehyde, glutathione, and catalase enzymes in broiler blood serum. The results indicate significant differences ($P \leq 0.05$) between treatments regarding MDA concentration, an indicator of lipid peroxidation. The results showed significant differences ($P \leq 0.05$) between all treatments. The negative control (T1) and positive control (T2) treatments recorded the highest MDA concentrations, at 5.13 and 4.87 mg/100 ml, respectively. In contrast, its concentration decreased significantly in the treatments treated with aloe vera oil, particularly treatment T5, which recorded the lowest value at 3.72 mg/100 ml, followed by treatment T6 at 4.06 mg/100 ml.

Regarding glutathione concentration, the results showed significant differences ($P \leq 0.05$)

between the treatments. Treatment T5 recorded the highest glutathione concentration at 37.48 U/L. Treatments T6 and T4 followed with values of 35.88 and 35.68 U/L, respectively, with no significant difference between them. Similarly, the control treatments recorded the lowest values of 29.99 and 30.85 U/L, respectively, with no significant difference.

Regarding catalase enzyme concentration, the results showed

significant differences ($P \leq 0.05$) between the treatments. Treatments T5 and T6 recorded the highest enzyme activity compared to the other treatments, with values of 54 and 52.84 IU, respectively. There were no significant differences between them. Meanwhile, the control treatments T1 and T2 recorded the lowest values, at 45.60 and 46.78 IU, respectively, compared to the treatments treated with aloe vera oil.

Table (3) Effect of methods of adding locally extracted and imported aloe vera oil on the concentration of antioxidants (Malondialdehyde, Glutathione and Catalase enzyme) in the blood serum of broiler chickens $\pm$ standard error.

Treatments	Malondialdehyd (mg/ 100 ml)	Glutathione (U/ L)	Catalase (IU)
T1	0.04 $\pm$ 5.13 a	$\pm$ 29.99 0.06 d	$\pm$ 45.60 0.10 c
T2	0.06 $\pm$ 4.87 b	$\pm$ 30.85 0.23 d	$\pm$ 46.78 0.18 c
T3	0.04 $\pm$ 4.63 c	$\pm$ 33.65 0.17 c	$\pm$ 50.51 0.17 b
T4	0.05 $\pm$ 4.37 d	$\pm$ 35.68 0.24 b	$\pm$ 51.10 0.12 b
T5	0.02 $\pm$ 3.72 f	$\pm$ 37.48 0.12 a	$\pm$ 54.00 0.08 a
T6	0.13 $\pm$ 4.06 e	$\pm$ 35.88 0.64 b	$\pm$ 52.84 0.97 a
Sig.	*	*	*

Table (3) shows a significant decrease in malondialdehyde levels, and an increase in both glutathione concentration and catalase enzyme activity, in all aloe vera oil treatments in this study. This aligns with the findings of Al-Salman's study (2023), which demonstrated that adding locally extracted aloe vera oil to broiler diets led to a clear improvement in antioxidant indicators. A significant decrease in serum malondialdehyde levels was observed, accompanied by a significant increase in glutathione concentration and catalase enzyme activity in the treated birds compared to the control group. The researchers attributed these results to aloe vera oil's ability to enhance the antioxidant defense system, due to its content of bioactive compounds such as flavonoids, anthraquinones, and vitamins, which contribute to reducing oxidative stress and improving physiological stability in the birds.

The significant response in oxidative stress indices may be attributed to the reduced impact of oxidative stress by potent antioxidant compounds, particularly anthraquinones, such as aloin. These compounds contribute to the protection of intracellular biomolecules, such as proteins, nucleic acids, unsaturated fatty acids, and sugars, from oxidative damage. Furthermore, they contribute to increased activity of liver enzymes, that reduce free

radical formation by limiting the production of hydrogen peroxide, lipid peroxides, and harmful hydroxyl radicals [24]

This improvement in oxidation indicators may also be attributed to the presence of anthraquinones in aloe vera leaves. These compounds contribute to inhibiting protein synthesis within pathogenic bacterial cells, which is essential for their growth and reproduction. Furthermore, aloe vera also contains saponins, which damage the bacterial cell membrane. A prominent anthraquinone is aloin, which helps reduce or inhibit free radical formation by decreasing peroxide production. This leads to increased catalase activity, thereby reducing oxidative stress [25]

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