INFLUENCE OF MEDICINAL PLANTS AND VITAMIN E ON PRODUCTIVE PERFORMANCE AND SOME PHYSIOLOGICAL PARAMETERS OF BROILER CHICKENS UNDER HEAT STRESS

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ABSTRACT

This study was aimed to evaluate the influence of adding dietary three medicinal plants and vitamin E on productive performance, serum physiological parameters, immunity and antioxidant status of broiler chickens under heat stress (34 - 38) C° for 35 days. A total of 600 Ross one day old broiler chicks were distributed randomly into eight treatments with five replicates 15 birds per each replicate as follows: T1: broiler were fed standard ration (negative control); T2: 50 mg vitamin E /kg ration (positive control); T3: 5g Dill powder /kg ration; T4: 10g Dill powder /kg ration; T5: 5g Adiantum powder /kg ration; T6: 10g Adiantum powder /kg ration; T7: 5g Crataegus powder /kg ration and T8: 10g Crataegus powder /kg ration. Live body weight, feed intake, feed conversion ratio and mortality rate were measured at weekly intervals. There was a significant effect of medicinal plants on live body weight at 35 day. However, non-significant difference was noticed on feed intake, significant differences on feed conversion ratio, mortality and livability%. Regarding male chickens, T3 treatment had significantly higher carcass yield as well as each of T3 male and T4 female had higher dressing percentage. Furthermore, higher production index was found in T4 while, high value of economic figure was shown in T5 as well as significant effect on serum thyroid hormone T3,T4, corticosterone hormone and enhanced total antioxidant capacity and stable malondialdehyde all helped to reduce oxidative stress as well as boost antibody titers of ND and IBD compared with T1. It can be concluded that the supplementation of medicinal plants to broiler´s diet had a beneficial effect on most of broiler performance, improving immunity, resistance characteristics and oxidative stress particularly in T4 (Dill10g/kg) under heat stress.

Key words: adainteum, crataegus, dill, broiler performance, antioxidant enzymes, hot climate.
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تأثير النباتات الطبية وفيتامين E على الاداء الانتاجي وبعض الصفات الفسلجية لفروج اللحم تحت الاجهاد الحراري

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المستخلص

هدفت الدراسة إلى تقييم تأثيراضافة ثلاثة نباتات طبية وفيتامين E الى العليقة على الأداء الإنتاجي وبعض الصفات الفسلجية والمناعيةوحالة مضادات الاكسدة لفروج اللحم تحت الإجهاد الحراري (34–38 درجة مئوية) لمدة 35 يوم. تم توزيع (600) افراخ فروج اللحم بعمر يوم Ross عشوائياً على ثمانية معاملات بواقع خمسة مكررات (15) طائر في كل مكرر على النحو التالي: T1: تم تغذية فروج اللحم على عليقة قياسية (سيطرة سالبة) , T2: 50 مغم فيتامين E / كغم عاف (سيطرة موجبة), T3: 5 غرام مسحوق السبت / كغم علف , T4: 10 غرام مسحوق السبت / كغم عاف , T5: 5 غرام مسحوق كزبرة البئر / كغم علف , T6: 10 غرام من مسحوق كزبرة البئر / كغم علف, T7: 5 غم من مسحوق اوراق الزعرور / كغم علف و T8: 10 غم مسحوق اوراق الزعرور / كغم علف. تم قياس وزن الجسم الحي و العلف المتناول و معدل التحويل الغذائي ومعدلات الهلاكات على فترات أسبوعية. في نهاية التجربة تم قياس كل من وزن الذبيحة و نسبة التصافي و الدليل الانتاجي و المؤشر الاقتصادي. بينت النتائج ان هناك تأثير معنوي للنباتات الطبية على وزن الجسم الحي مع انعدام الفروقات المعنوية في العلف المتناول بينما وجدت اختلافات معنوية في كفاءة التحويل الغذائي ومعدل الهلاكات ونسبة الحيوية. فيما يتعلق بذكور الدجاج كانت معاملة T3 أعلى معنويًا في وزن الذبيحة ، كما ان لكل من ذكورالمعاملات T3 و T4 اعلى نسبة تصافي. علاوة على ذلك ارتفع الدليل النتاجي في T4 بينما كان اعلى قيمة للمؤشر الاقتصادي في المعاملة T5. كما كان له تأثير معنوي ($P<0.05$) على هورمونات الغدة الدرقية T3، T4، هرمون الكورتيكوستيرون. وقد ساعد تعزيز القدرة الكلية لمضادات الأكسدة والمالونديالدهيد المستقر على تقليل الإجهاد التأكسدي بالإضافة إلى زيادة الأجسام المضادة لـ ND وIBD عند مقارنتها بالسيطرة السالبة والموجبة. يمكن الاستنتاج أن إضافة النباتات الطبية إلى علف فروج اللحم كان له تأثير مفيد على معظم صفات الاداء الانتاجي وتحسين المناعة والاجهاد التاكسدي خاصة في المعاملة الرابعة (السبت 10 غم /كغم علف) تحت الاجهاد الحراري.

كلمات مفتاحية: كزبرة البئر، اوراق الزعرور، السبت، الكفاءة الانتاجية، انزيمات مضادة للاكسدة والمناخ الحار.
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INTRODUCTION

High ambient temperatures are a main source of stress for livestock animals (1). Modern lines of broiler chickens are particularly sensitive to high temperatures because of their speed growth, high body weight and good feed conversion (9) which limits the body's capacity to adapt to uncomfortable thermal conditions (6). For homeothermic animals, the thermal comfort zone is the range of temperatures where the animal requires the least amount of energy to maintain body temperature (8). The thermoneutral zone in which hens may maintain their body temperature is between 18 and 24°C. Heat exchange between a bird and its surroundings is impeded when temperatures are above its thermoneutral zone, which results in altered physiological and metabolic processes such endocrine disturbance. Oxidative stress (37), behavioral changes (16) and decreased production and quality of meat (33). Many studies claimed that increased bird mortality and decreased weight gain caused by high ambient temperatures result in large economic losses (16). In order to decrease heat stress and improve poultry performance in hot weather several strategies have been devised. Nutritional manipulation has been a common approach in poultry production (34). For instance, using of nutrients such as medical plants, probiotics, trace elements and vitamins has also been proven beneficial in relieving the adverse influences of heat stress (34). Consequently, in order to deal with the problems caused by heat stress the use of medical plants and plant extracts as natural antioxidants has been considered (45). Medical plant extracts supplementation against stressors improved immune system (24, 40). Additionally, using vitamin E as an artificial antioxidant increases live body weight, body weight gain and improved feed conversion ratio (41). The objective of this study was to investigate the effects of different levels of medicinal plants and vitamin E on production performance, some physiological parameters, immunity and antioxidant status of broiler chickens under heat stress.

MATERIALS AND METHODS

The present study was carried out in August 2021, on commercial poultry project in Rovain, Kurdistan region-Iraq. The experiment was performed on (day-old of 600 Ross chicks) which were randomly distributed into 8 treatments at 5 replicates (15 birds per replicate) reared during 35 days under heat stress. The chicks were brought from a local commercial hatchery (Eiteemad Hatchery) in Bardarash region and kept in cages (1.5 m x 1m x 1m) width, length, and high respectively with separate door for each cage. The ration was formulated to meet the nutrient requirements of chicks according to (26). The birds were fed with basal diet without any plant supplement in T1 (negative control), 50mg/kg diet vitamin E in T2 (positive control), 5g/kg diet dill powder in T3, 10g/kg diet dill powder in T4, 5g/kg diet Adiantum powder in T5, 10 g/kg diet Adiantum powder in T6, 5g/kg diet Crataegus powder in T7 and 10 g/kg diet Crataegus powder in T8 added to standard diet. Forty litter cages had one feeder and one drinker in each replicate. Feed and drinking water were given *ad libitum* and three phases of feeding were adopted, standard broiler starter from (1- 14 d), grower from (15-21 d) and finisher (22- 35 d) as shown in (Table 1). Table (2-4) illustrated the active compound of dill, Adiantum and Crataegus respectivlly. The house was controlled in temperature and humidity by a thermostat, and all treatments have had the same conditions. In the first week, the temperature was between 32- 34°C and gradually reduced. At the 14 day birds were exposed to heat stress until 35 day of age, temperature-simulated cyclic heat stress (HS): maintained at 36 ± 2C° for 6 hours from 10: am to 4: pm until the end of experiment. The range was between 19-24°C with 65- 55% humidity. Lighting was provided 23 hours per day with 1 hours of darkness, apart from d 1 to 7 when 23 hours of lighting were provided according to the Rose 308 broiler management handbook, 2018. During 35 days of the experiment, live body weight LBW(g), body weight gain BWG (g), feed intake FI(g/bird), feed conversion ratio FCR(g feed/ g weight), mortality%, livability %, production index (PI) and economic figure had been recorded weekly. On the last day of the experiment one male and females from each replicate were slaughtered to obtain carcass and dressing percentage and had taken blood

collected in the tube without anticoagulants to obtain serum for determination of thyroxine T4 (nmol/L) and triiodothyronine T3 (nmol/L) and corticosterone hormone concentration in plasma was determined using ELIZA according to the instructions of the kit included in the Buyer's Guide for Life Science Boi-compare. Moreover, immunity tests against Newcastle Disease ND antibody titer and Infectious Bursal disease IBD. Besides, antioxidant status (TAC) and (MDA) were determined by ELIZA according to the instructions of the kit included in the Enzo Life Science. The data collected were analyzed through CRD (Completely Randomized Design) using the program SPSS software (39) and to compare differences among treatments, Duncan's multiple range test were employed (10).

Table 1. Broiler (Ross 308) diet Ingredients and chemical compositions.

Ingredients	Starter (1-14d)	Grower (15-21d)	Finisher 22- 35d))
Wheat	65	66	69
Soya bean meal	27	25	23
Sun flower oil	3.0	3.5	3.8
Limestone	1.2	1.2	1.0
Premix	3.6	3.7	2
Antitoxin	0.2	0.6	1.2
Total	100	100	100
	Calculated Nutrient Composition		
Metabolic energy kcal/kg	2900	3000	3100
Crud protein %	23.35	22.50	21.88
Fiber %	2.31	2.49	2.59
Ash%	5.48	5.66	5.88
Fat %	3.89	4.04	4.12

***Each 1 Kg contains: Vitamin A 400000 IE, vitamin B6 40mg, Vitamin D3 80000 IE, Cholin chloride 1000 mg, vitamin E (acetate) 1000 IE, Cholecalciferol 2.000 mg, Vitamin K3 60 mg, Fe: Fe (II) sulf. 2000 mg, Vitamin B130 mg, Cu: CuSO4.5H2O 200 mg, vitamin B2 200 mg, Zn: ZnOxyde 1600 mg, Pantothenic acid 300 mg, Mn: Mn (II) oxide 2400 mg, Niacin 1200mg, Co: Co (II) carbon 6 mg, Biotin 2000 mcg, I: Ca – Iodate 30 mg, Vitamin B12 600 mcg, Se: Na – selenite 4 mg and Folic acid 20 mg**

Quantitative detection of the most important active compounds present in Dill,Adaintum and Crateagus leaf extract powder analyzed by Chromatography/Mass Spectrometry (GC-MS) were illustrated in Tables (2-4).

Table 2. Active compounds of Dill extract powder

No	Total content of active compounds	Concentration
1	Total phenolic content (mg / 100 gm)	451.25
2	Total flavonoid content (mg / 100gm)	298.58
3	Total alkaloid content %	33.21
4	Total glycoside content %	16.58
5	Total saponins content %	6.25
6	Total carotene content %	3.65
No	Active compound	Con.
1	Qurcetine (mg / kg)	48.5
2	Carvone (mg / kg)	135.59
3	Limonene (mg / kg)	174.5
4	Thymol (mg / kg)	39.15

Table 3. Active compounds of in Adiantum extract powder

No	Total content of active compounds	Concentration
1	Total phenolic content (mg / 100 gm)	312.0
2	Total flavonoid content (mg / 100gm)	244.5
3	Total alkaloid content %	18.9
4	Total glycoside content %	22.5
5	Total saponins content %	4.5
6	Total carotene content %	12.0
No	Active compound	Con.
1	Qurcetine (mg / kg)	45.8
2	Rutin (mg / kg)	15.3
3	Luteolin (mg / kg)	20.6
4	Kaempferol (mg / kg)	29.5

Table 4. Active compounds of in Crataegus extract powder

No	Total content of active compounds	Concentration
1	Total phenolic content (mg / 100 gm)	264.1
2	Total flavonoid content (mg / 100gm)	188.5
3	Total alkaloid content %	15.9
4	Total glycoside content %	6.9
5	Total saponins content %	3.5
6	Total carotene content %	6.2
No	Active compound	Con.
1	Qurcetine (mg / kg)	41.2
2	Kaempferol (mg / kg)	16.8
3	Thymol (mg / kg)	112.2
4	Limonene (mg / kg)	93.5

RESULTS AND DISCUCSSION

Table (5) shows that addition of different levels of (Dill, Adiantum, Crataegeus and vitamin E) on live body weight (LBW) were no significant differences (P<0.05) at 7-14 days in birds that were received medicinal herbs and vitamin E. While, on the last three weeks (21-35) of the experiment were found significant (P<0.05) differences on live body weight (LBW) among treatment addition compared with negative control T1 and positive control T2. The present findings are agreed with those reported by (14, 41) who suggested that medicinal plants leave supplementation had a significant effect (P<0.05) on body weight of birds. In addition, (22) reported that there were a significant effect (P<0.05) on live body weight in both male and female bird when fed medicinal plants. The reason for this significant superiority (p<0.05) may be attributed to the active compounds present in Tables (2, 3 and 4) for Dill, Adaintum and Crataegus leaf powder such as (alkaloids and flavonoids) in improving the efficiency of digestion by stimulating the increase in the secretion of a group of enzymes such as lipase, protease and amylase, which have an important role in the process of digestion and absorption through their prominent role and in the analysis of carbohydrate, fatty, protein and saliva food components as well as calming the stomach, digestive system and improving appetite (44). Furthermore, that the medicinal plants contain substances (carvone and thymol) Table (2-4) that may be improve regulate the temperature of the body when exposed to thermal stress such as (36). In addition, the improvement of live body weight under heat stress and treated with medicinal plants especially Dill supplement as concentrate (10) g/kg diet compared with other treatments T1 and T2 could return to Dill are rich in nutritional value as shown in Table (2) may increase of appetizing and increase feed consumption as well as, rise gut enzymes and HCL activities and bile in small intestine and increase of nutrient absorption and finally increased of live body weight (44).

Table 5. Effect of adding some dietary medicinal plants and vitamin E on weekly live body weight (LBW) of broiler under heat stress conditions. (Mean ± SE).

Treatment	Body weight (g)				
	7 days	14 days	21 days	28 days	35 days
T1	175.80±0.55	436.99±11.41	825.48±14.00^{c}	1319.86±24.72^{d}	1883.06±31.34^{c}
T2	179.81±0.68	442.94±12.74	833.32±3.24 ^{bc}	1341.53±3.28^{d}	1948.46±24.02^{c}
T3	177.83±3.11	454.64±2.53	856.78±3.01 ^{ab}	1407.20±3.12^{c}	2104.00±50.89^{b}
T4	178.25±1.14	456.12±2.07	868.30±0.93^{a}	1520.60±11.86^{a}	2248.80±34.97^{a}
T5	178.88±0.79	456.92±4.13	862.38±15.97 ^{ab}	1439.86±2.77^{b}	2135.80±51.17^{ab}
T6	177.22±0.81	438.12±13.90	849.30±13.08^{abc}	1490.20±3.15^{a}	2147.02±52.41^{ab}
T7	179.47±1.23	440.14±10.47	848.97±4.42^{abc}	1447.13±12.19^{b}	2141.64±42.30^{ab}
T8	179.59±0.53	451.74±6.70	862.07±4.61^{ab}	1488.10±6.10^{a}	2162.63±50.68^{ab}
S.L	N.S	N.S	P≤0.05	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum, T6: 10gm Adiantum, T7: 5gm Crataegus, T8: 10gm Crataegus per kg diet**

Table (6) showed weekly body weight gain (BWG g) of broiler recorded significant differences (P<0.05) among all treatments compared with the negative control group (T1) and positive control (T2). The current results were agreed with those of (14, 3) who detected increasing body weight gain (p<0.05) throughout the trial. On the other hand, the findings are in contrast with those reported by (43) who found non-significant differences in body weight gain among treated birds at 42 days. The reason for the significant superiority of the treatments in the different levels of Dill, Adaintum and Crataegus leaves powder and in different time periods may be attributed to the fact that these plants contain active substances including flavonoids that have a structure and action similar to steroid hormones (35) as these hormones increases the rate of food metabolism, play an important role in promoting the growth of the body and play an essential role in the manufacture of structural proteins in the muscles of the body (35). Also, flavonoid compounds are natural antioxidants in the body where they enter in the composition of some important enzymes such as glutathione peroxidase which protect tissues from the free radicals damages such as peroxides in addition, to its role in preventing the demolition of body proteins and thus achieving the best daily weight gain for the body of the bird (29).

Table 6. Effect of adding some dietary medicinal plants and vitamin E on weight gain of broiler under heat stress. (Mean ±SE).

Treatment	Body weight gain(g)					Total weight gain
	7 days	14 days	21 days	28 days	35 days	1-35 days
T1	130.80±0.55	261.19±11.91	388.48±14.04	49.38±37.47^{f}	563.20±35.36^{b}	1838.06±31.50^{c}
T2	134.81±0.68	263.12±12.65	390.37±11.67	508.20±4.32^{ef}	606.93±21.91^{ab}	1903.46±24.15^{c}
T3	132.83±3.11	276.80±2.02	402.14±3.49	550.41±1.44d^{e}	696.80±50.61^{ab}	2059.00±50.69^{b}
T4	133.25±1.14	277.86±1.01	412.17±2.72	652.29±12.62^{a}	728.20±31.43^{a}	2203.80±34.29^{a}
T5	133.88±0.79	278.04±3.58	405.46±15.98	577.47±16.58^{cd}	695.93±49.38^{ab}	2090.80±51.35^{ab}
T6	132.22±0.81	260.90±14.62	411.17±21.45	640.89±15.59^{ab}	656.82±50.93^{ab}	2102.02±51.93^{ab}
T7	134.47±1.23	260.67±10.60	408.83±10.69	598.15±11.95^{bcd}	694.50±45.85^{ab}	2096.64±43.44^{ab}
T8	134.59±0.53	272.15±6.25	410.32±9.61	626.03±7.20^{abc}	674.53±50.54^{ab}	2117.63±50.76^{ab}
Sig.	N.S	N.S	N.S	P≤0.05	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum, T6: 10gm Adiantum, T7: 5gm Crataegus, T8: 10gm Crataegus per kg diet**

Table (7) showed total feed intake (FI) at 1-35 days. A significant difference was found in T3, T4, T5, T7, and T8 compared with T1, T2, and T6. The present findings are in agreement with those reported by (31, 14 and 38). Conversely, our results disagreed with (43).The improvement in feed utilization and growth performance due to adding of medicinal plants may be due to an improvement in the metabolic rate caused by an increase in enzymatic activity and feed consumption increasing the production of digestive enzymes by improving liver function and stimulating birds to eat more feed (18). In addition, the medicinal plants contain fructoids which improve digestive feed intake and then absorption as a result of stimulating secretion of pancreas and intestinal (11). Besides, medicinal plant-supplementation causes better absorption of nutrients in the diet and eventually leads to higher body weight which causes improvements in the growth and feed conversion ratio of broiler chickens (44). In our findings, the improvement of feed intake may be attributed to the utilization of medicinal plants (Dill, Adiantum and Crataegus) leaf powder of presence active compound (querestin , thymol and carvone) which increased appetite as a result consuming animal more feed. There is an indication to suggest that herbs, spices and different plant extracts enhanced appetite and digestion stimulating properties (42). Moreover, medicinal plants leaves and spices extract or oil, flavoring substances and vegetable extracts (alkaloids and saponins) directly acting on the hypothalamus in the appetite center with sense of smell and feeding behavior that led to increases feed intake (28). Heat stress generally cause stress and the period of this stress effect on appetite center in the brain and decrease feed intake in birds' exposure to heat

stress (28). Additionally, improvement feed intake in Dill treatment may be due of glucocorticoids rise the production of free radicals, inducing atrophy of the muscle fibers and then increased the total weight of digestive tract organs and improved feed consumption (12).

Table 7. Effect of adding some dietary medicinal plants and vitamin E on feed intake (gram) of broiler under heat stress. (Mean ± SE).

Treatment	7 days	14 days	21 days	28 days	35 days	1-35 days
T1	132.08±2.82	281.35±12.93	473.46±10.69	743.33±57.99^{c}	976.65±64.61	2606.90±63.35^{b}
T2	136.90±3.12	283.85±13.27	461.84±12.01	752.15±10.78^{c}	1034.01±37.68	2668.76±49.17^{b}
T3	135.58±4.38	297.16±3.45	479.02±8.58	807.33±4.57^{bc}	1183.61±80.12	2902.73±86.70^{a}
T4	135.59±1.78	294.84±2.91	493.54±5.52	911.73±13.97^{a}	1083.38±43.13	2919.10±49.17^{a}
T5	135.37±2.27	299.18±12.82	489.81±23.08	831.96±21.28^{ab}	1170.57±81.73	2926.90±86.70^{a}
T6	135.05±1.99	277.53±14.50	492.41±27.31	904.62±23.57^{a}	1014.16±75.02	2823.80±81.43^{ab}
T7	137.74±2.82	280.28±12.50	500.38±15.88	866.10±21.14^{ab}	1158.73±79.41	2943.25±72.89^{a}
T8	136.66±1.78	289.57±12.46	493.72±6.98	888.39±12.45^{a}	1109.93±75.02	2918.29±83.34^{a}
Sig.	N.S	N.S	N.S	P≤0.05	N.S	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum,T6: 10gm Adiantum,T7: 5gm Crataegus,T8: 10gm Crataegus per kg diet**

Table (8) focused on feed conversion ratio (FCR). At 7- 28 days, non-significant differences were found while at 35 days, there was an improvement in (FRC) among all treatments that supplemented with medicinal plants. However, the results were changed and expanded during the last week of the experiment. At 35 days, all treatments showed improvement in FCR compared with T1 and T2. FCR in T3, T4, T5, T6, T7and T8 respectively were significantly (P<0.05) improved compared to T1 and T2. Additionally, at 1-35 day recorded significant differences (P<0.05) between treatments T4, T6 with other treatment and compared with T1and T2, the higher FCR in Dill supplement at the level of 10 g/kg diet which was the optimum dose of supplementation. The reason for the differences on feed conversion ratio at 35 days may be due to luteolin and limonene concentrations which are present in (Dill, Adiantum, and Crataegus) and give herbals their attractive aroma have also been shown to enhance appetite and palatability qualities and accelerate animal digestion processes (7). The present findings are agreed to (14, 24) who showed improvement in the productive performance by using medicinal plants in poultry diets. Conversely, (31, 43) concluded statistically non-significant differences in FCR observed between control and treated birds when Dill seeds were used over the experimental period.

Table 8. Effect of adding some dietary medicinal plants and vitamin E on feed conversion ratio (gm diet/ g weight gain) of broiler under heat stress. (Mean ± SE).

Treatment	7 days	14 days	21 days	28 days	35 days	1-35 days
T1	1.010±0.023	1.077±0.009	1.222±0.031	1.502±0.013^{a}	1.732±0.019^{a}	1.417±0.012^{a}
T2	1.015±0.025	1.079±0.007	1.183±0.014	1.479±0.013^{ab}	1.704±0.024^{ab}	1.401±0.010^{a}
T3	1.020±0.023	1.073±0.009	1.190±0.015	1.466±0.008b^{c}	1.700±0.008^{ab}	1.409±0.007^{ab}
T4	1.018±0.020	1.061±0.010	1.197±0.010	1.398±0.007^{e}	1.489±0.020^{d}	1.324±0.006^{c}
T5	1.010±0.011	1.074±0.033	1.206±0.013	1.44±0.006^{cd}	1.682±0.005^{ab}	1.399±0.006^{ab}
T6	1.021±0.012	1.064±0.006	1.197±0.010	1.411±0.007^{e}	1.546±0.026^{c}	1.343±0.012^{c}
T7	1.024±0.014	1.074±0.009	1.223±0.015	1.447±0.009^{cd}	1.667±0.012^{b}	1.403±0.006^{ab}
T8	1.015±0.014	1.064±0.013	1.204±0.015	1.418±0.007^{de}	1.649±0.018^{b}	1.377±0.006^{b}
Sig.	N.S	N.S	N.S	P≤0.05	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum, T6: 10gm Adiantum, T7: 5gm Crataegus, T8: 10gm Crataegus per kg diet**

Table (9) revealed that the mortality percentages had significantly (P<0.05) lower in the treatments of medicinal plants and vitamin E compared with the T1 group. In

addition, the livability percentages also differ significantly (P<0.05) in T2, T3, T5, T6, T7, T8 and T4 compared with T1. The present findings are in agreement with (31) who found that 1g Dill leaves powder/kg diet did not affect mortality. The reason of no mortality in T4 (dill group) may be due to the improvement in body weight, weight gain and health positively affected to reducing the mortality percentages. Besides, Dill plants had thymol, carvone and phenolic compound which consider as antioxidant and increased immunity. Herbal-enhanced functional feeds improved the birds' overall health and immune status (32) which led to a lower death rate in the herbal-enhanced treatments.

Table 9. Effect of adding some dietary medicinal plants and vitamin E on mortality rate and livability percentage of broiler under heat stress. (Mean ± SE).

Treatment	Mortality%	Livability%
T1	9.33±3.39^{a}	90.67±3.39^{b}
T2	5.33±2.49^{ab}	94.67±2.49^{ab}
T3	2.67±1.63^{ab}	97.33±1.63^{ab}
T4	0.00±0.00^{b}	100.00±0.00^{a}
T5	5.34±1.33^{ab}	94.66±1.33^{ab}
T6	2.67±1.63^{ab}	97.33±1.63^{ab}
T7	4.00±1.63^{ab}	96.00±1.63^{ab}
T8	2.67±2.67^{ab}	97.33±2.67^{ab}
Sig.	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum,T6: 10gm Adiantum,T7: 5gm Crataegus,T8: 10gm Crataegus per kg diet**

Table (10) pointed that the best value of PI was significantly (P<0.05) higher in T4, T6, T8, T7, T3, T5 and T2 respectively compared with the T1 group. Production index achieved high values in all treatments of medicinal plants and vitamin E as compared with control group. Moreover, measuring the economic figure which is considered an important indicator of the success of poultry breeding projects (25). Economic figure achieved high values in all T5, T4, T7, T8 and T6 as compared with T2 and T1 group. Value of production index and economic figure was convergent value and the addition of 10g/kg diet Dill in broiler rations indicated an improvement in the production efficiency and increased the value of its economic indicator. The best value of economic figure was in T4 (421.06) because the lowest proportion of deaths in the flock lead to higher economic figure. The current findings agreed with (13). On the other hand, the findings are in contrast with (14) who found non-significant variation on economic figure between the all experimental groups.

Table 10. Effect of adding some dietary medicinal plants and vitamin E on production index and economic figure of broiler under heat stress. (Mean ± SE).

Treatment	Production Index	Economic Figure
T1	344.31±15.22^{d}	388.05±14.15^{b}
T2	376.28±13.03^{c}	383.70±7.59^{b}
T3	414.75±6.45^{b}	403.84±15.56^{ab}
T4	485.12±8.80^{a}	419.77±6.66^{a}
T5	412.69±10.30^{b}	421.06±12.42^{a}
T6	444.85±14.73^{b}	411.77±11.94^{a}
T7	418.20±5.46^{b}	416.87±14.14^{a}
T8	435.86±9.47^{b}	416.52±20.67^{a}
Sig.	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum,T6: 10gm Adiantum,T7: 5gm Crataegus,T8: 10gm Crataegus per kg diet**

Table (11) showed that was found significant differences (p<0.05) on carcass weight of both male and female broiler as well as significant differences (p<0.05) on dressing percentage of female broiler compared with control group. On the other hand, non-significant differences

of male broiler. The current results agreed with (2). However, the results are disagreed with findings by (22, 43). In general, the improvement in carcass weight and dressing % may be due to the role of medicinal plants contents as active compounds in Table (2, 3 and 4) to increase live body weight and then increase of carcass weight and dressing percentage. Furthermore, the reduction in muscle mass seen in T1 group could be related to the effect of heat stress and there was no herbal supplementation to relieve the stress which increases protein susceptibility to proteolysis around or above 32°C (33) resulting in a decline in protein deposition in muscles and thus decrease in muscle mass. The reason for this significant superiority in the average carcass weight in both genders may be attributed to the positive relationship between the live body weight and the carcass weight as a result the higher weight gain which leads to an increase in the average live body weight and thus is reflected in the weight of the carcass (5). In addition to, the reason may be the improving in growth performance was a result of improving in bird's health and then improved carcass weight (19).

Table 11. Effect of adding some dietary medicinal plants and vitamin E on carcass weight and dressing percentage of male and female of broiler under heat stress. (Mean ± SE).

Treatment	Carcass weight(gram)		Dressing Percentage	
	Male	Female	Male	Female
T1	1357.80±54.87^{b}	1377.80±14.10^{c}	71.87±1.89	73.98±0.53^{ab}
T2	1445.60±11.33^{b}	1485.20±25.46^{b}	72.73±1.16	74.71±1.10^{ab}
T3	1608.00±25.82^{a}	1492.40±26.23^{b}	76.46±1.22	71.80±1.51^{b}
T4	1564.40±49.32^{a}	1595.00±27.26^{a}	74.03±2.22	76.12±1.14^{a}
T5	1590.60±58.64^{a}	1564.20±41.45^{ab}	75.03±2.19	74.89±1.51^{ab}
T6	1572.60±23.16^{a}	1597.00±22.52^{a}	73.88±1.14	75.62±1.00^{ab}
T7	1586.40±22.28^{a}	1555.20±36.61^{ab}	74.82±0.97	73.64±1.24^{ab}
T8	1572.80±25.30^{a}	1549.40±22.76^{ab}	74.15±1.13	73.33±1.24^{ab}
Sig.	P≤0.05	P≤0.05	N.S	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum, T6: 10gm Adiantum, T7: 5gm Crataegus, T8: 10gm Crataegus per kg diet**

Table (12) recorded results of the effect of medicinal plants (Dill, Adiantum, Crataegus) and vitamin E of broilers under heat stress on thyroid hormones (T3 and T4) were documented as metabolic indicators and corticosterone hormone was documented as a stress indicator. The hormones data revealed that there were significant differences (P<0.05) of Triiodothyronine (T3 ng/mL) between treatment groups and between both male and female sex of broiler compared with T1 and T2. In addition to, Thyroxine hormone (T4 ng/mL) levels in all treatments were higher significant than T1 of male and female. The supplementation of medicinal plants like (Dill, Adiantum, and Crataegeus) may improve oropharyngeal receptors which are directly linked to the appetite center located in the hypothalamus, may induced the secretion of thyroxin and triiodothyronine from the thyroid gland, that enhance protein, carbohydrate and fat metabolism (35). Concerning stress hormone corticosterone (ng/mL) concentration was varied among treatments between male and female broiler, there were found significant differences (P<0.05) as comparison with other treatments of male and female broiler because generally corticosterone hormone increases during heat stress and when supplemented with medicinal plants decreased compared with T1and T2 under heat stress because these medicinal plants considered as anti-stressor which then decrease levels of corticosterone hormone. As a result of increasing the release of T3, T4 and decreasing corticosterone levels in chicken blood, this may act as an anti-stressor effect on thyroid action (21). The current findings are in agreement with (4) who determined that raising temperature to (32-35) ^{o}C causes heat stress and increases serum corticosterone levels in chickens fed without supplements.=

Table 12. Effect of adding some dietary medicinal plants and vitamin E on serum thyroid hormone of male and female of broiler under heat stress .(Mean±SE).

Treatment	Serum thyroid hormones (ng/mL)					
	T3(Triiodothyronin)		T4(Thyroxine)		Corticosterone	
	Male	Female	Male	Female	Male	Female
T1	1.11±0.071^{c}	1.06±0.031^{d}	1.24±0.052^{d}	1.04±0.138^{c}	19.96±0.27^{a}	18.75±0.24^{a}
T2	1.21±0.059^{bc}	1.14±0.069^{cd}	1.32±0.014^{cd}	1.32±0.012^{b}	15.97±0.22^{b}	15.73±0.26^{b}
T3	1.25±0.017^{ab}	1.20±0.029^{bc}	1.42±0.006^{bcd}	1.43±0.017^{b}	15.38±0.13^{bc}	15.37±0.13^{bc}
T4	1.28±0.023^{ab}	1.32±0.014^{ab}	1.79±0.122^{a}	1.69±0.098^{a}	14.77±0.28^{cde}	14.33±0.46^{d}
T5	1.32±0.025^{ab}	1.31±0.043^{ab}	1.59±0.119^{ab}	1.46±0.037^{b}	14.10±0.15^{e}	14.06±0.19^{d}
T6	1.35±0.044^{a}	1.25±0.057^{abc}	1.45±0.012^{bcd}	1. 45±0.008^{b}	14.44±0.17^{de}	14.53±0.19^{cd}
T7	1.36±0.036^{a}	1.36±0.039^{a}	1.48±0.018^{bc}	1.44±0.016^{b}	14.95±0.25^{cd}	14.92±0.25^{bcd}
T8	1.35±0.016^{a}	1.29±0.052^{ab}	1.55±0.073^{b}	1.51±0.049^{ab}	15.56±0.29^{cd}	14.89±0.27^{bcd}
Sig.	P≤0.05	P≤0.05	P≤0.05	P≤0.05	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum, T6: 10gm Adiantum, T7: 5gm Crataegus, T8: 10gm Crataegus per kg diet**

Table (13) indicated that the effect of medicinal plants and vitamin E on broilers immune response against Newcastle disease Virus (NDV) and Infectious bronchitis disease (IBV) under high heat stress conditions. The result revealed that antibody titers against NDV and IBV were increased significantly (P<0.05) in treatments provided with selected herbals and under heat stress and led to be close the result of T2,T3, T4,T5,T6,T7,T8 compared with TI. In addition, there were found significant differences in both sexes' male and female of broiler immune response T4 as supplement 10g dill powder /kg diet recorded the highest antibody titers against NDV and IBD of male and female. The finding is corroborative with the findings of (15, 22) when used medicinal plants and found that antibody titers to Newcastle disease were higher. According to (30) polysaccharides made from medicinal herbs increased antibody titers in hens that had received vaccinations. The results are disagree by (20) when used some medicinal plants and found that the treatments did not change (p>0.05) antibody responses to the Newcastle disease vaccine (LaSota). The ability to increase the level of immunity could be a arrival to containing a good concentration of (qurestin, thymol, carvon and lanoline on each herbals as shown in Table (2) as well as flavonoid chemicals in dill are powerful antioxidants which improve the birds' immune systems (17). In heat stress condition the blood levels of all antibodies were lower while when added medicinal plants increased the broilers' antibody levels because the bioactive compounds found in plants such as limonene and thymol which have antibacterial, antiviral, antiparasitic, antifungal, antioxidant and antihelminthic properties (27).

Table 13. Effect of adding some dietary medicinal plants and vitamin E on immunity response against Newcastle disease virus (NDV) and Infectious Bursal disease (IBD) under heat stress of male and female of broiler (Means± SE).

Treatment	Antibodies titer against diseases (ng/ml)			
	Newcastle Titer		Gumboro Titer	
	Male	Female	Male	Female
T1	2450.52±5.66^{g}	2431.68±22.00^{f}	1276.44±12.00^{d}	1269.71±18.06^{c}
T2	4339.60±3.83d^{e}	4346.69±38.03^{de}	3142.89±230.27^{c}	3181.10±214.07^{b}
T3	3795.92±49.57^{f}	4453.09±13.10^{bcd}	3617.24±162.25^{b}	3441.09±17.84^{ab}
T4	4727.54±27.12^{a}	4626.40±18.91^{a}	4322.76±10.71^{a}	3880.36±199.08^{a}
T5	4581.72±43.26^{b}	4559.11±55.11^{ab}	3764.67±198.25^{b}	3732.78±183.11^{a}
T6	4408.52±15.27^{d}	4323.71±67.72^{e}	3569.14±14.21^{b}	3528.05±13.86^{ab}
T7	4319.12±13.19^{e}	4403.06±34.52^{cde}	3601.18±130.90^{b}	3739.20±311.19^{a}
T8	4498.69±27.89^{c}	4497.69±27.41^{bc}	3940.74±128.00^{ab}	3664.50±206.31^{a}
Sig.	P≤0.05	P≤0.05	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum,T6: 10gm Adiantum,T7: 5gm Crataegus,T8: 10gm Crataegus per kg diet**

Table (14) observed the supplementation of (Dill, Adiantum, Crataegeus and vitamin E) had effect on the oxidative enzyme's concentration in serum. The results of total antioxidant capacity (TAC) were significantly (P<0.05) higher concentration than in serum of male broiler in all treatments of Dill, Adiantum, Crataegeus and then vitamin E (T4, T5, T6, T8, T7 and T2) respectively compared with T1. Also, there were significantly higher concentration than in serum of female broiler in all treatments (T4, T5, T7, T8, T3, T6 and T2) respectively compared with T1. While, malondialdehyde (MDA) had significantly (P<0.05) lower concentration than in serum of male and female broiler in all treatments compared with T1. Antioxidant enzyme activity was boosted and serum MDA levels were lowered; this beneficial effect on antioxidant metabolism is likely attributable to the many active components of medicinal plants and spices that can reduce free radicals and thus prevent lipid peroxidation (23).

Table 14. Effect of adding some dietary medicinal plants and vitamin E on MDA (malodaldyhide) and TAC (total antioxidant capacity) of male and female of broiler (Means± SE).

Treatment	Serum antioxidant enzymes activity			
	MDA(mmol/ml)		TAC(mmol/ml)	
	Male	Female	Male	Female
T1	3.22±0.049^{a}	3.26±0.047^{a}	0.78±0.018^{e}	0.82±0.013^{d}
T2	2.20±0.018^{e}	2.17±0.037^{c}	1.03±0.079^{d}	1.10±0.095^{c}
T3	2.36±0.050^{d}	2.29±0.040^{c}	1.21±0.062^{cd}	1.19±0.060^{c}
T4	2.69±0.010^{b}	2.55±0.059^{b}	2.04±0.012^{a}	2.04±0.010^{a}
T5	2.51±0.040^{c}	2.45±0.041^{b}	1.77±0.155^{b}	1.63±0.176^{b}
T6	2.24±0.047^{e}	2.22±0.045^{c}	1.31±0.104^{c}	1.18±0.011^{c}
T7	2.16±0.018^{e}	2.20±0.036^{c}	1.23±0.009^{cd}	1.24±0.016^{c}
T8	2.21±0.014^{e}	2.18±0.024^{c}	1.27±0.037^{cd}	1.19±0.014^{c}
Sig.	P≤0.05	P≤0.05	P≤0.05	P≤0.05

***a,b,c Means with different superscripts in the same column differ significantly (p<0.05) and N.S=non-significant. T1 (negative control): standard diet, T2 (positive control): 50mg vitamin E, T3: 5gm Anetheum, T4: 10gm Anetheum, T5: 5gm Adaintum, T6: 10gm Adiantum, T7: 5gm Crataegus, T8: 10gm Crataegus per kg diet**

CONCLUSIONS

In general, the dietary medicinal plants powders have a beneficial effect on most productive performance; higher live body weight was recorded at T4 group (Dill 10g/kg),various levels of dietary herbs treatments affected carcass traits and T3, T4 group (Dill 5,10g/kg) had recorded the best carcass weight and dressing percentage in male and female. Correspondingly, enhanced physiological traits, improved disease resistance by decreasing mortality rate, increased antibody titer against diseases, sustain the antioxidant statues (activate TAC) and reduce (MDA) these changes enable the rearing of healthy broiler and more immunity chicks.

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