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EFFECT OF SILYMARIN SUPPLEMENTATION ON THE PERFORMANCE OF DEVELOPED CHICKENS UNDER SUMMER CONDITIONS

1-DURING GROWTH PERIOD

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ABSTRACT: This study was conducted to investigate the effect of milk thistle plant (Silybum marianum) as a phytoantioxidant for improving the performance of Gimmizah cockerels during summer season (18 June –26 August, 2017). One hundred and twenty five Gimmizah cockerels aged 21-day were individually weighed and randomly divided into five treatment groups. Each treatment was represented by five replicates, of 5 cockerels each and housed in 25 rearing cages (open system) until the end of the experiment (91 day of age). The first group was used as a control and fed the unsupplied basal diet (without any agent). The second group was fed the basal diet supplemented with vitamin E (150 mg VE /kg diet) as an immunomodulator nutrient. The third group was fed the basal diet supplemented with 0.5g commercial silymarin (SLM) /kg diet. The fourth and the fifth groups were fed the basal diet supplemented with 12.5 and 25g of fine grind aerial parts of milk thistle plant (MTh) /kg diet as a natural source of SLM (represented 0.5 and 1g SLM /kg diet, respectively). Diets were kept isocaloric and cover nutrient requirements of the experimental birds. All birds received feed and water ad-libitum throughout the experimental period. The chemical analysis indicated that MTh contain 188.5 mg of total polyphenols and 320 mg of antioxidant activity /100g sample. Body weight of cockerels fed diet supplied with different agents was significantly increased compared to the control group through all experimental periods. In addition, the group supplied with 25 g MTh /kg diet induced the highest BW and BWG followed by those supplied with VE. Supplementation of cockerels diet with different agents significantly improved feed intake and feed conversion ratio during the whole experimental period compared to the control group. The results indicated that the relative weights of dressing, liver, spleen, bursa of Fabricius and testes significantly increased for the groups supplied with different agents compared to the control group. Moreover, the group supplied with 25g MTh /kg diet significantly increased relative weight of liver and bursa of Fabricius compared with the other experimental groups. Supplying cockerels diets with different agents significantly improved all blood biochemical constituents compared to the control group. However, diet supplied with both levels of MTh significantly improved the liver function (AST, ALT and ALP) and significantly decreased lipid profile (total lipids, triglycerides and cholesterol) compared with the group fed diet supplied with VE and the control groups. Diets supplied with different agents significantly improved TAC, GSH, MDA, lymphocyte, the heterophil to lymphocyte ratio (H/L ratio), phagocytic activity and phagocytic index compared to the control.

Key words: Cockerels-Milk thistle-Silymarin- Performance-Carcass-Antioxidant.

INTRODUCTION

Due to the steadily rising global average surface temperature, heat stress has emerged as the major concerns in the poultry industry. The poultry production in Egypt suffering from the changeful of the ambient temperature which can remain consistently high for extended periods of time in addition to sudden recurrent hot and humid waves which have more harmful effect. This changeful causing significant loss in poultry production every year due to heat stress which leading to an economic losses to the poultry farmers. Increasing the ambient temperature above 30˚C represents a heat- stressed condition for birds and is one of the most common stressors that affect the production criteria in poultry where the ideal temperature for broilers is 10-22˚C to get optimum body weight and 15-27˚C for feed efficiency (Daghir, 2008, Attia et al., 2011 and Rama Rao et al., 2011).

Heat stress (HS) adversely affects feed intake, body weight gain, feed conversion ratio, carcass quality and immune response (Temim et al., 2000, Attia et al., 2011, and Abou Shehema, 2013). In addition, lipid peroxidation under heat stress increased as a consequence of increased free radical generation, a condition that enhances the formation of reactive oxygen species (ROS) and induces oxidative stress in cells. Tatli Seven (2008) indicated that the increase in lipid peroxidation decreases antioxidants such as vitamin E and vitamin C in tissues. Increasing body reserves of antioxidants may help animals with the production of free radicals by eliminating the harmful effect of heat stress and inhibiting the oxidation reactions (Botsoglou et al., 2004). Reducing stress in poultry remains a topic of concern amongst producers and scientists. Several methods are available to alleviate the negative effects of high environmental temperature on performance of poultry. The researcher today focused mostly on the dietary manipulation due to the high cost and impractical of cooling animal buildings (Konca et al., 2009). Vitamin E plays a crucial role in cell-protection by preventing the peroxidation of lipid and free radicals scavengers (Metwally, 2003; Khan et al., 2011; Ghazi et al. 2012). Niu et al. (2009) reported that body weight gain (BWG) was effectively maintained by 100 mg/kg VE supplementation under the chronic HS, whereas chronic HS severely reduced growth and immune parameters of broilers; however, interestingly the immune response of broilers was improved by dietary VE supplementation under chronic HS. Moreover, Rajput et al. (2009) found that broilers fed a diet supplemented with 300 mg VE had greater body weight gain than the control group. Shelf life may also be improved by VE supplementation due to delayed oxidative stress and lipid peroxidation (Attia et al., 2006), protects lymphocytes, macrophages and plasma cells against oxidative damage and enhances immune cell functions and proliferations (Khan et al., 2012).

Phytogenic plants are a good source of antioxidants. Moreover, they are safe for both living organisms and the environment (Windisch et al., 2008). Wu et al. (2009) reported that milk thistle plant (Silybum marianum) had been identified as a source of various phytochemicals. Also, they reported that Silybum marianum contains silymarin, which is composed of the flavanolignans silybin, silydianin, and silychristine, with silybin being the most biologically active. Silymarin is found in highest concentrations in the fruit portion of the plant but is also found in the leaves and seeds. Silymarin is the active component of milk thistle, which represent 4 % of the dried seeds or in the aerial parts of milk thistle plant (Pradhan and Girish, 2006; Rajiha, 2012). Silymarin acted as an excellent antioxidant, scavenging reactive oxygen species (ROS) and inhibiting lipid peroxidation, thereby protecting cells against ROS (Kshirsagar et al., 2013). Free radicals, including the superoxide radical, hydroxyl radical, hydrogen peroxide and lipid peroxide radicals have been implicated in liver diseases, cancer, inflammation and neurodegenerative diseases (Miguez et al., 1994; Valko et al., 2006).

The objective of this study is to determine if silymarin, from aerial parts (leaves, barks and fruits) of milk thistle plant could be equivalent to commercial silymarin or vitamin E for improving the performance, carcass characteristics and blood constituents of Gimmizah cockerels during summer season.

MATERIALS AND METHODS

The present study was carried out at El-Sabahia Poultry Research Station, Alexandria Governorate belonging to Animal Production Research Institute, Agriculture Research Center. The experiment was conducted from 18 June to 26 August 2017 to investigate the effect of aerial parts of milk thistle plant (Silybum marianum, family: Compositaet.) on performance, carcass characteristics and blood constituents of the Gimmizah cockerels in summer season.

Preparing the material

Dried milk thistle plant (MTh) was purchased from the local market and ground to a fine powder using an electric dry mill. The powder stored in well-tied black plastic bags at room temperature (≈25°C) until used in the formulation of the experimental diets. Total phenolic compounds (equivalent to Gallic acid) according to Fogliano et al. (1999) and antioxidant activity (equivalent to ascorbic acid) were determined according to Viuda-Martos et al. (2010), (Table 1).

Birds, management and experimental design

A total number of 125 Gimmizah cockerels aged 21-day were individually weighed and randomly divided into five treatment groups. Each treatment group was represented by five replicates, of 5 cockerels each and housed in 25 rearing cages (open system) until the end of the experiment (91 day of age). The first group was used as a control and fed the basal diet without any supplementation. The second one was fed the basal diet supplemented with vitamin E (150 mg VE /kg diet) used as an immunomodulator nutrient. The third group was fed the basal diet supplemented with 0.5g of commercial silymarin per kg diet (SLM). The fourth and the fifth groups were fed the basal diet supplemented with 12.5 and 25.0 g of fine grind aerial parts of milk thistle plant (MTh) /kg diet as a natural source of SLM (represented 0.5 and 1g SLM/ kg diet, respectively)), as grind milk thistle aerial parts, including leaves, barks and fruits, containing 4.0% of silymarin (Rajiha, 2012). Diets were kept isocaloric and cover nutrient requirements of the experimental birds according to Feed Composition Table for Animal and Poultry Feedstuffs in Egypt (2001), as shown in Table (2). All birds were kept under similar management conditions in rearing cages. Feed and water were provided ad libitum throughout the experimental period.

Measurements

All birds were individually weighed (g) and recorded every 2 weeks. Feed intake (FI) and mortality during these periods were also recorded. Body weight gain (BWG) was calculated and used to determine feed conversion ratio (FCR) (g feed/g gain).

Carcass traits and some lymphoid organs

At 91 day of age, ten cocks from each treatment were selected randomly and slaughtered for carcass evaluation. Carcass was eviscerated and head and shank were removed then, liver, gizzard, heart, proventriculus, pancreas, testes, spleen, thymus, bursa of Fabricius were dissected from the viscera and weighed. Each portion was expressed as a percentage of life body weight.

Blood analyses

At the end of the experiment, in the morning (at 09.00 to 10.00 O'clock), two blood samples (3 ml, each) were collected from the brachial vein, (one into heparinized tube to separate plasma and the other one into unheparinized tube to separate serum) of five birds / replicate. The fresh blood samples were used for determination of hemoglobin (Hb), red blood cell count (RBCs), packed cells volume (PCV), white blood cell counts (WBCs). White blood cell differential was done according to Hawkey and Dennett (1989). Plasma was immediately separated by centrifugation for 10 minutes at 3200 rpm. Plasma total protein (g/dl), albumin (g/dl), globulin, glucose concentration (mg/dl), alkaline phosphatase (ALP), creatinine were determined using commercial kits produced by Diamond Diagnostics Company (29 Tahreer St. Dokki Giza Egypt). The activity of serum aspartate amino transferase (AST), and serum alanine amino transferase (ALT), were determined by spectrophotometrically using available commercial Kits. Serum total antioxidant capacity (TAC), glutathione (GSH) and Malondialdehyde (MDA) were colorimetrically determined using commercial Kits. The phagocytic activity (PA) and phagocytic index (PI) were measured as suggested by Leijh et al. (1986).

The Temperature-Humidity Index

The indoor temperature (°C) and relative humidity (RH %) were recorded through summer months (18 June –26 August, 2017). The estimation of the temperature humidity index (THI) is shown in chart (Figure 1) according to Thom (1959), Weather Safety Index (LCI, 1970; Gross and Siegel, 1983).

Economical efficiency

The total feed cost (L.E/ bird) at the end of the experiment for each treatment, was calculated depending upon the local market prices of the ingredients used for formulating the experimental diet Price of Kg diet (assuming that 1 Kg unsupplied diet = 4.9 LE, cost kg of VE = 200 LE, cost of supplied commercial silymarin = 0.50 LE, 1 Kg MTh= 30.0 LE). Also, the total revenue (L.E/bird) was calculated depending upon the market price of the 1 kg BW (32 LE/kg). Economical efficiency (EE) and relative economic efficiency (REE) were calculated according to input-output analysis.

Statistical analysis

Data were analysed using the GLM procedure of Statistical Analyses Software® (SAS 1996) using one-way

ANOVA according to the following model:

$Yij = \mu + tj + eij$,

Where, Yij = any observation, μ = the general mean, tj = the effect of treatment, eij = the experimental error. Differences among treatment means were estimated by Duncan's multiple range test (Duncan, 1955).

RESULTS

Total polyphenols and antioxidant activity on MTh

The chemical analysis indicated that MTh contain 188.5 mg of total polyphenols and 320.0 mg of antioxidant activity /100g sample (Table 1).

Temperature degrees (°C) and relative humidity (%)

Data of Table (3) shown the averages of the indoor ambient temperature (°C) and relative humidity (RH %) which were recorded daily during the experimental period (18 June –26 August, 2017). The maximum environmental temperatures and humidity during June, July and August were 32.32, 33.7 and 33.3 °C and 76.8, 77.3 and 79.1 %, respectively, while, the averages of environmental temperatures were 27.9, 29.4 and 28.8 °C and 59.7, 58.0 and 59.3 %, respectively (Table3).

Body weight and body weight gain

Data of Table (4) showed that the initial BW (21- day old) was not significantly different among the experimental groups. Generally, BW of cockerels fed diet supplied with different agents was significantly increased compared to the control group through all experimental periods. Supplementation of basal diet with 25g MTh /kg diet and VE recorded the significant highest BW at 35, 63 and 77 day of age compared with the other experimental groups. However, supplementation with 25g MTh /kg diet induced the highest BW recorded followed by those supplied with 12.5g MTh /kg diet and VE at 91 day of age. Supplementation with 25 g MTh /kg diet and VE significantly increased BWG during 21-35, 36-49, 50-63 and for whole experimental period compared to the control group. However 25 g MTh /kg diet induced the highest BWG at 91 day of age.

Result of survival rate indicated that increasing temperature induced an increasing in the mortality rate to about 4 % for the control group while the other treated groups had no records of death during the experimental period (Table 4).

Feed intake and feed conversion ratio

The results of feed intake and feed conversion ratio indicated that FI of cockerels fed diet supplied with VE, SIM and both MTh levels was significantly increased during 36- 46, 50- 63 and for whole experimental period compared to the control group Table (5). However, supplementation diet with 25g MTh /kg diet and VE significantly increased FI during 21- 35 compared with other experimental groups. In addition, both levels of MTh and SIM significantly increased FI during 78- 91compared to the control group. Moreover, all supplementations had no significant influence on FI during 64 -77 days of age. Cockerel diets supplied with 25 g MTh /kg diet and VE significantly improved FCR during 21-35, 36-49 and for whole experimental period compared to the unsupplied group. While, supplementation of cockerels diet with 12.5g MTh /kg diet and VE significantly improved FCR during 50-63 and the whole experimental period. Moreover, all supplementations had no significant influence on FCR during 64-77 and 78 - 91 day of age.

Carcass traits and some lymphoid organs

The carcass results indicated that the relative weights of dressing, liver, spleen, bursa of Fabricius and testes significantly increased for the groups supplied with different agents compared to the control group (Table 6). Moreover, the group supplied with 25g MTh /kg diet significantly increased relative weight of liver and bursa of Fabricius compared with the other experimental groups. However, supplementation with different agents had no significant effects on the relative weights of pancreas, thymus, intestine weight and intestine length as well as abdominal fat.

Biochemical constituents

Results of Table (7) demonstrated that diets supplied with VE, SIM and both MTh levels significantly improved total protein AST, ALT, creatinine, total lipids, triglycerides, cholesterol, HDL, LDL, TAC, GSH and MDA compared to the control group. Diets supplied with both levels of MTh significantly improved the liver function and lipid profile, since the activity of AST, ALT, ALP, total lipids, triglycerides and cholesterol significantly decreased compared with that in the group fed diet supplied with VE and the control groups. In addition, diet supplied with 25 g MTh /kg diet significantly increased total protein and TAC compared with other supplemented groups. The plasma glucose concentration was not significantly affected by different agents compared with the control group.

Hematological constituents

Hematological parameters for cockerels fed diet supplemented with VE, SIM and both MTh levels under hot summer condition are represented in Table (8). Diets supplied with different agents significantly increased red blood cells counts (RBCs) and hemoglobin (Hb) compared to the control group. Blood white cells counts (WBCs), packed cell volume (PCV), lymphocyte, phagocytic activity (PA) and phagocytic index (PI) percentages were significantly improved for the groups supplied with different agents compared with the control group, and these were insignificantly differed among them . Diets supplied with both levels of MTh significantly decreased the heterophil percentage compared to the control group and statistically equal with the groups supplied with VE and SIM. Also, different agents significantly decreased the heterophil to lymphocyte ratio (H/L ratio). Monocyte and eosinophil percentages were not significantly affected by diet supplied with different agents.

Economical Efficiency

The economical efficiency of dietary supplementation treatments are recorded in Table (9). The results indicated that chicken diet supplied during summer environmental condition with 150 mg VE/kg diet recorded the best relative economical efficiency (115.2%) followed by the group supplied with 12.5 g MTh/kg diet (112.0%) compared with the control group.

DISCUSSION

The phytochemical screening for Milk thistle aerial parts (leaves, barks and fruits) showed that the total polyphenols content and antioxidant activity are 188.5 mg/100g and 320 mg/100g, respectively (Table 1). In this respect, Kim et al. (2011) indicated that phenolic substances have been shown to be responsible for the antioxidant activity of plant materials. Also, higher antioxidant activity has been positively correlated with the concentration of phenolic compounds in extracts.As shown in the present work, averages indoor ambient temperature (^{o}C) and relative humidity (RH%) indicated that Gimmizah cockerels exposed to high environmental temperatures and relative humidity percentages during the summer conditions (Table 3). However, the THI zones according to Temperature-Humidity Index (THI) chart (Figure 1) was 85 at the maximum temperature degrees and humidity percentages from the day during the summer season. That means the cockerels exposed to an emergency stress during June, July and August 2017, respectively according to Weather Safety Index (LCI, 1970 and Gross and Siegel, 1983). The average of ambient temperature recorded in our study was outside the established thermoneutral zones of 12–24 °C in poultry species reared in temperate regions (Plyaschenko and Sidorov **,** 1987) and 20.9– 28.5 °C in poultry species reared in the tropical regions of the world (Prinzinger et al., 1991). Similarly, the extremely high relative humidity recorded in this study was about two times higher than the values of 30 to 40 %, established for chickens raised in the tropics (Oluyemi and Roberts, 2000). Water evaporation from the body depends on the relative humidity which cannot occur if the air is saturated with water vapor. So that high ambient temperature with high relative humidity is very stressful (Ayo et al., 1996), and heat dissipation by evaporative cooling is impeded (Keim et al. , 2002). This finding agrees with the report of Marai et al. (2002) that animals raised under environmental conditions with temperature-humidity index higher than 29 °C suffer from heat stress. Also, Dei and Bumbie (2011) demonstrated that high air dry-bulb temperature and high relative humidity (RH), characteristic of the hot-humid season result in heat stress.

The evidence of negative effects of increasing temperature at the present work is the increase of mortality rate which recorded about 4 % for the control group while the other treated groups had no records of death during the experimental period (Table 4). This increase in mortality could be due to inhibition of some immune responses. Ayo et al. (2010) mentioned that high environmental temperatures causing heat stress in poultry resulted in stressful behavioral responses which may cause death due to heat stroke. Also, Ayo et al. (2005: 2011) and Kusandi and Djulardi (2011) reported that high ambient temperature and high relative humidity induce heat stress in livestock. The significant reduction in body weight is one of the main disadvantages of adjustment to high ambient temperature, which results from the increased energy demand by thermoregulation and the decline in feed intake (Kusandi and Djulardi 2011; Dzenda et al. 2012). Dietary manipulations are preferable to other methods used in order to alleviate the detrimental effects of high environmental temperature because of their practicability and lower cost (Sahin et al. 2004; Sinkalu et al. 2009; Singh et al. 2012). Wu et al. (2009) reported that milk thistle plant (Silybum marianum) had been identified as sources of various phytochemicals. This fact suggests that adverse effects of environmental stress are largely due to induction of oxidative stress (Lin et al. 2002; Sahin et al. 2002; Singh et al. 2012).

The present study demonstrated a reduction in BW for the cockerels fed diet without any reagent supplied . Generally, BW of cockerels fed diet supplied with different agents was significantly increased compared to the control group, through all experimental periods. However, supplementation of cockerels diet with 25 g MTh /kg diet induced the highest BW and BWG (by 19.59 and 23.64 %, respectively) followed by those supplied with 12.5 g MTh /kg (by 14.05 and 17.05 %, respectively) and VE (by 13.91 and 16.96 %, respectively), while the group supplied with SIM increased BW and BWG by 9.66 and 12.12 %, respectively, at the end of the experimental period, compared to the control group. The results indicated that MTh and VE had an enhancing effect causing a complete recovery in body weight of cockerels. The effect of VE indicates the beneficial effect on cell mediated immunity and antioxidants status (Khan et al ., 2011; Surai et al., 2001). The beneficial influence of VE shows increasing the oxygen level, it supports the growth of muscles (Surai et al., 2001). Heat stress stimulates the release of corticosterone and catecholamines and initiates lipid peroxidation in cell membrane and decrease animal welfare that can be reduced by VE (Metwally, 2003). VE supplementation in diets is necessary under heat stress conditions due to it's provide protection for those cells involved in immune responses (lymphocytes, macrophages and plasma cells) against oxidative damage and enhances proliferation and functions of these cells, thus improving the animal welfare. Dietary supplementation with 250 mg vitamin E/kg before, during and after heat stress is optimum for alleviating, at least in part, the adverse effects of heat stress (Bollengier-Lee et al., 1999). In addition, Çiftçi et al. (2005) showed that VE reduced the negative impact of high ambient temperature on chicken performance. The improvement caused in BW and BWG for the groups supplied with both levels of MTh and SIM may be related to that silymarin had a powerful antioxidant herbal drug which can protect biological systems against the oxidative stress. Asghar and Masood (2008) demonstrated that silymarin may be used in preventing free radical-related diseases as a dietary natural antioxidant supplement.It is suggested that silymarin can enter into the nucleus and act on RNA polymerase enzymes and the transcription of rRNA, resulting in increased ribosomal formation. This in turn hastens protein and DNA synthesis (Sonnenbichler and Zetl, 1986), which enhances the biosynthetic apparatus in the cytoplasm, thus leading to an increase in the synthesis rate of both structural and functional proteins. At least conceptually, this stimulation may enable cells to counteract the loss of transporters and enzymes occurring under many pathological conditions. Shalan et al., (2006) noted that addition of vitamin C, E, selenium and silymarin as a combination improves the biochemical, molecular, physiological and histopathological parameters of male albino rats under heat stress condition (40±2°C). Chand et al. (2011) found that milk thistle supplementation significantly increased broiler chicken body weight gain. Also, Muhammad et al. (2012) found that milk thistle supplementation (at 10 g/kg diet) significantly improved broiler chicken body weight gain. The FI reduction observed in this study for unsupplied group is agreement with the fact that exposing to heat stress reduced cockerels FI and appetite. Supplementation with different agent increased the FI by 11.28, 8.57, 7.02 and 7.87 % for the groups supplied with 25 g MTh /kg diet, 12.5 g MTh /kg, SIM and with VE, respectively compared with unsupplied group (control). Thus, the FCR was improved for the aforementioned groups by 10.53, 7.77, 4.76 and 8.02%, respectively compared with control group. These results confirms with earlier studies obtained by Scott and Balnave (1988), McKee et al. (1997) and Kirunda et al. (2001). In addition, Hurwitz et al. (1980) showed that appetite is also decreased as a primary response to high temperature. Niu et al. (2009) and Azad et al. (2010) indicated that feed intake, live weight gain, and feed efficiency in broiler chickens were decreased during high temperature. However, Chand et al. (2011) found that milk thistle supplementation significantly improved feed conversion ratio in chicken. In the same line, Muhammad et al. (2012) found that milk thistle supplementation (at 10 g/kg diet) significantly increased feed intake and improved feed conversion ratio. Experimental results indicated that plasma glucose concentration was not significantly affected by supplied diets with different agents compared with the control group. However, Bhattachrya (2011) reported that silymarin can protect the pancreas against certain forms of damage. The current results indicated that supplied diets with VE, SIM and both MTh levels significantly improved total protein albumin and globulin and the significant highest improvement indicated for the group supplied with 25 mg MTh/kg diet by 8.4, 9.4 and 11.7 %, respectively compared to the control group (Table 7). Also, supplementation with different agents significantly improved the liver function compared to the control group. However, supplementation of SIM and both levels of MTh has more effect than VE. Supplementation of SIM and both levels of MTh reduced AST by 33.8, 39.6 and 38.2 % compared to the control group and by16.4, 27.8 and 26.0 % compared to the group supplied with VE, respectively. Also, ALT reduced by 27.8, 39.8 and 41.3 % compared to the control group and by 10.3, 17.5 and 19.6 % compared to the group supplied with VE, respectively. These results are in line with Simanek et al. (2000) who reported that milk thistle seeds have been used as herbal folk medicine mainly for the treatment of liver diseases. Also, Shaker et al. (2010) indicated that Silybum marianum used for relieving the liver diseases and that might be due to potent silymarin mixture and its mechanism of action mainly as antiradical and anticarcinogenic roles that may be due to the decreased liver enzyme levels. Moreover, Bhattachrya (2011) indicated that in patients with acute viral hepatitis, silymarin shortens treatment time and shows an improvement in serum bilirubin, and serum liver enzymatic levels also, in chronic active hepatitis silymarin treatment improves liver function tests. Supplyig diets with VE, SIM and both MTh levels significantly improved kidney function since the creatinine concentration was significantly reduced (between 10.0 and 15.3 %) compared to the control. That result is in line with Bhattachrya (2011) who reported that silymarin helps to maintain normal renal function and silibinin reduces oxidative damage to kidney cells in vitro. Diets supplied with both levels of MTh significantly improved the lipid profile, since the activity of total lipids, triglycerides and cholesterol significantly decreased compared with that in the group fed diet supplied with VE and the unsupplied group (control) However, supplementation of both levels of MTh significantly reduced total lipids by 21.9 and 22.3 %, triglycerides by 11.1 and 10.5 % and cholesterol by 11.5 and 12.1 %, respectively compared to the control. Also, supplementation of different agents significantly increased HDL and reduced LDL concentrations compared to the control. Moreover, MDA concentration was significantly reduced for the groups supplied with different agents (between 27.0 and 27.6 %) compared to the control group. The current results are in agreement with Sobolova et al. (2006) who showed , using an in vitro study, that silymarin has a hypolipidemic effect and preventive effect on low density lipoprotein peroxidation. Also, Soto et al.(2004) indicated that silymarin is a strong antioxidant that has been promote liver cell regeneration, reduce blood cholesterol and to help prevent cancer. Moreover, Kshirsagar et al. (2009) and Kreeman et al. (1998) reported that silymarin could represent a novel agent in the prevention and therapy of hypercholesterolemia and atherosclerosis. Also, Bhattachrya (2011) demonstrated that Silymarin-induced reduction of biliary cholesterol and phospholipids in both rat and human may be in part due to decreased liver cholesterol synthesis. Results reported herein indicated that the antioxidant and the immunity statues for the groups supplied with different agents were significantly improved compared with the unsupplied group. However, the measuring of TAC and GSH as an antioxidant barometers were significantly improved for all supplied groups and the best improvement for TAC was 19.7 % for the group supplied with MTh compared with control group and the improvement of GSH was ranged between 2.1 and 2.8 %, compared with control group. In the same respect, Gross and Siegel (1983) demonstrated that heterophil to lymphocyte (H/L) ratio has been widely used as a responsive indicator of chronic stress related to immune function in laying hens. Also, Nicol et al. (2009) referred that this ratio could be utilized as an index of hen welfare. Also, Cravener et al. (1992) reported that physiological and physical stressors increase the H/L ratio and haematocrit values decreased in birds exposed to heat stress. The results in the present work demonstrated the improving range of RBCs count was ranged between 21.37 to 51.37 %, Hb concentration by 15.27 to 31.19 % and packed cells volume percentage by 9.23 to 16.39 % compared with control group. Also, some immune indices as WBCs counts, lymphocyte, H/L ratio, phagocytic activity, % and phagocytic index, % were significantly improved by range between 13.73 to 22.16, 5.02 to 8.03, 11.54 to 17.54, 13.85 to 22.17 and 18.80 to 29.32 %, respectively (Table 8). These results are compatible with the results of many clinical investigation and trials conducted on livestock animals which demonstrated that silymarin diet supplementation can improve productive performance and health status with particular regard to hepatic function (Quarantelli et al., 2004). Moreover, Das et al. (2008) and Kshirsagar et al. (2009) reported that silibinin exhibits membrane protective properties and it may protect blood constituents from oxidative damage.

Bhattachrya (2011) and Kshirsagar et al., 2013) reported that silymarin has been act as an excellent antioxidant, scavenging free radicals (reactive oxygen species) and inhibiting lipid peroxidation. It augments the non-enzymatic and enzymatic antioxidant defense systems of cells involving reduced glutathione, superoxide dismutase and catalase. Long term administration of silymarin improves immunity by increasing T-lymphocytes, interleukins and reducing all types of immunoglobulins. Sliymarin can be useful in development of therapeutic adjuvant in which immunosupression is required including autoimmune and infectious diseases (DerMarderosian, 2001 & Das et al, 2008).

IN CONCLUSION,

cockerels diet supplied with 25g MTh /kg diet (equal to 1g SLM /kg diet) improved the performance, carcass characteristics and blood constituents of Gimmizah cockerels during summer season. However, supplementation of 12.5 g MTh /kg diet recorded more economical than 25 g MTh /kg die

Table (1): Average ±SE of total polyphenols (equivalent to Gallic acid) and antioxidant activity (equivalent to ascorbic acid)

Sample	Total polyphenols (equivalent to Gallic acid)	Antioxidant activity (equivalent to ascorbic acid
Milk thistle aerial parts (mg/ 100 g)	188.5±3.30	320.0±10.0

Table (2): Formulation and composition of the basal diet

Ingredients %		Calculated composition	
Yellow Corn	63.80	Crude protein (%)	18.0
Corn Gluten Meal (60%)	9.30	Metabolically energy (k cal/kg diet)	2850
Soybean meal (44%)	16.00	Ether extract %	2.91
[1]Vit . Min . Mix.	0.30	Crud fibers %	2.42
NaCl	0.30	Calcium %	3.18
Di-calcium phosphate	2.06	Available phosphorus %	0.50
Limestone	8.00	Lysine %	0.89
L-Lysine HCl	0.22	Methionine %	0.39
DL-Methionine	0.02	Total sulpher amino acids (TSAA)	0.69
Total	100.00		

[1]Vit. Min. mixture provides per kilogram of diet: vitamin A, 12000 IU; vitamin E, 10 IU; menadione, 3 mg; Vit. D_3, 2200 ICU; riboflavin, 10 mg; Ca pantothenate, 10 mg; nicotinic acid, 20 mg; choline chloride, 500 mg; vitamin B_{12}, 10 µg; vitamin B_6, 1.5 mg; vitamin B_1, 2.2 mg; folic acid, 1 mg; biotin, 50 µg. Trace mineral (milligrams per kilogram of diet): Mn, 55; Zn, 50; Fe, 30; Cu, 10; Se, 0.10; Anti oxidant, 3 mg.

Table (3): The temperature degrees (°C) and relative humidity (%) during the summer of 2017

Months	Temperature degrees °C			Relative humidity %		
	Average	Maximum	Minimum	Average	Maximum	Minimum
June	27.9±1.79	32.32±2.56	22.1±1.79	59.7±6.42	76.8±4.89	39.2±9.20
July	29.4±1.07	33.7±1.78	25.1±1.42	58.0±5.44	77.3±6.41	39.1±8.75
August	28.8±0.99	33.3±0.73	24.1±1.85	59.3±3.46	79.1±6.51	39.5±5.03

Table (4): Effect of vitamin E, commercial silymarin and grind aerial parts of milk thistle plant (Silybum marianum) on body weight gain of Gimmizah cockerels reared under summer condition

Criteria	Control	VE[1]	SIM[2]	MTh[3] 12.5 g/kg diet	MTh[3] 25 g/kg diet	SEM	P Value
Initial body weight, (g/bird) 21d	221	219	218	221	220	5.55	0.5952
Body weight, (g/b/period)							
BW, at 35 days	448^{b}	497^{a}	458^{b}	454^{b}	521^{a}	10.82	0.0001
BW, at 49 days	612^{d}	734^{b}	687^{c}	667^{c}	773^{a}	13.66	0.0001
BW, at 63 days	782^{c}	957^{a}	907^{b}	891^{b}	981^{a}	13.95	0.0001
BW, at 77 days	1019^{c}	1191^{a}	1139^{b}	1142^{b}	1237^{a}	16.69	0.0001
BW, at 91 days	1253^{d}	1426^{b}	1374^{c}	1429^{b}	1496^{a}	20.14	0.0001
Body weight gain, (g/b/period)							
BWG 21 - 35 days	226^{b}	278^{a}	239^{b}	233^{b}	301^{a}	11.36	0.0004
BWG 36 - 49 days	164^{d}	236^{ab}	229^{bc}	213^{c}	252^{a}	7.43	0.0001
BWG 50 - 63 days	170^{b}	223^{a}	220^{a}	224^{a}	208^{a}	7.09	0.0001
BWG 64 - 77 days	237	234	232	251	256	8.65	0.2244
BWG 78 - 91 days	234^{b}	235^{b}	236^{b}	286^{a}	259^{ab}	10.13	0.0035
BWG 21 - 91 days	1032^{c}	1207^{ab}	1156^{b}	1208^{ab}	1276^{a}	10.56	0.0001
Survival rate	25/1	25/0	25/0	25/0	25/0	ND	ND

^{a,b,c} means having different superscripts in the same row are significantly different (P<0.05).

SEM: standard error of means P value: probability level ND: not done

VE: Vitamin E. SIM: Commercial silymarin. MTh: Milk thistle plant.

Table (5): Effect of vitamin E, commercial silymarin and grind aerial parts of milk thistle plant (Silybum marianum) on feed intake and feed conversion ratio of Gimmizah cockerels reared under summer condition

Criteria	Control	VE[1]	SIM[2]	MTh[3] 12.5 g/kg diet	MTh[3] 25 g/kg diet	SEM	P Value
Feed intake (g/b/day)							
FI 21 - 35 days	49.94^{c}	54.76^{ab}	52.64^{bc}	52.12^{cd}	55.79^{a}	1.20	0.0001
FI 36 - 49 days	51.8^{c}	55.69^{b}	56.08^{b}	58.04^{b}	62.22^{a}	1.48	0.0001
FI 50 - 63 days	57.68^{b}	64.17^{a}	62.04^{a}	64.88^{a}	64.73^{a}	1.56	0.0001
FI 64 - 77 days	64.49	67.14	64.85	66.27	66.99	3.54	0.4047
FI 78 - 91 days	69.63^{b}	73.49^{ab}	77.73^{a}	76.58^{a}	76.13^{a}	2.52	0.0086
FI 21 - 91 days	58.56^{b}	63.05^{a}	62.67^{a}	63.58^{a}	65.17^{a}	1.16	0.0001
Feed conversion ratio (g feed: g BWG)							
FCR 21 - 35 days	3.12^{a}	2.76^{b}	3.10^{a}	3.14^{a}	2.59^{b}	0.105	0.0001
FCR 36 - 49 days	4.40^{a}	3.29^{c}	3.44^{c}	3.87^{b}	3.47^{c}	0.163	0.0001
FCR 50 - 63 days	4.82^{a}	4.06^{b}	3.97^{b}	4.05^{b}	4.47^{ab}	0.271	0.0475
FCR 64 - 77 days	3.95	4.03	3.92	3.67	3.66	0.211	0.0859
FCR 78 - 91 days	4.18	4.52	4.61	3.83	4.11	0.298	0.0604
FCR 21 - 91 days	3.99^{a}	3.67^{bc}	3.80^{ab}	3.68^{bc}	3.57^{c}	0.104	0.0057

^{a,b,c} means having different superscripts in the same row are significantly different ($P<0.05$).

SEM: standard error of means, P value: probability level.

VE: Vitamin E. SIM: Commercial silymarin. MTh: Milk thistle plant.

Table (6): Effect of vitamin E, commercial silymarin and grind aerial parts of milk thistle plant (Silybum marianum) on carcass characteristics of Gimmizah cockerels reared under summer condition

Criteria	Control	VE[1]	SIM[2]	MTh[3]		SEM	P Value
				12.5 g/kg diet	25 g/kg diet		
Dressing, (g/100g LBW)	77.58^{b}	80.72^{a}	80.40^{a}	80.75^{a}	81.00^{a}	0.645	0.0012
Liver, (g/100g LBW)	1.98^{e}	2.35^{d}	2.47^{c}	2.59^{b}	2.70^{a}	0.034	0.0001
Pancreas, (g/100g LBW)	0.204	0.191	0.212	0.219	0.207	0.018	0.3656
Spleen, (g/100g LBW)	0.194^{b}	0.263^{a}	0.281^{a}	0.264^{a}	0.253^{a}	0.018	0.0329
Thymus, (g/100g LBW)	0.305	0.410	0.420	0.391	0.414	0.034	0.2698
Bursa of Fabricius,(g/100g LBW)	0.191^{c}	0.217^{b}	0.236^{ab}	0.239^{ab}	0.253^{a}	0.012	0.0001
Testes, (g/100g LBW)	0.342^{c}	0.672^{b}	0.642^{b}	0.812^{a}	0.652^{b}	0.162	0.0456
Intestine weight(g/100g LBW),	4.32	4.49	4.30	4.27	4.33	0.208	0.6080
Intestine length, (cm/100g LBW)	9.93	9.55	9.89	9.94	9.36	0.235	0.4265
Abdominal fat (cavity), (g/100g LBW)	0.190	0.216	0.188	0.174	0.185	2.62	0.7952

^{a,b,c} means having different superscripts in the same row are significantly different ($P<0.05$).

SEM: standard error of means, P value: probability level.

VE: Vitamin E. SIM: Commercial silymarin. MTh: Milk thistle plant.

Table (7): Effect of vitamin E, commercial silymarin and grind aerial parts of milk thistle plant (Silybum marianum) on some blood biochemical constituents of Gimmizah cockerels reared under summer condition

Criteria	Control	VE[1]	SIM[2]	MTh[3] 12.5 g/kg diet	MTh[3] 25 g/kg diet	SEM	P Value
Glucose, (mg/dl)	184	192	186	193	190	4.71	0.5971
Total protein, (g/dl)	5.71^{c}	5.99^{b}	5.95^{b}	6.03^{b}	6.19^{a}	0.070	0.0008
Albumin, (g/dl)	3.41^{d}	3.59^{c}	3.55^{c}	3.71^{b}	3.73^{a}	0.049	0.0072
Globulin, (g/dl)	2.30^{b}	2.40^{b}	2.40^{b}	2.32^{b}	2.57^{a}	0.061	0.0216
AST, (U/L)	69.00^{a}	57.67^{b}	45.67^{c}	41.66^{c}	42.67^{c}	2.65	0.0001
ALT, (U/ L)	44.33^{a}	32.33^{b}	29.00^{c}	26.67^{d}	26.00^{d}	1.05	0.0001
ALP, (U/100 ml)	14.57^{a}	13.90^{ab}	13.77^{b}	13.40^{b}	13.53^{b}	0.320	0.0578
Creatinine, (mg/dl)	1.50^{a}	1.33^{b}	1.35^{b}	1.27^{b}	1.34^{b}	0.051	0.0455
Total lipids, (g/dl)	5.39^{a}	4.50^{b}	4.30^{c}	4.21^{d}	4.19^{d}	0.028	0.0001
Triglycerides, (mg/dl)	190^{a}	177^{b}	174^{b}	169^{c}	170^{c}	1.96	0.0001
Cholesterol, (mg/dl)	156^{a}	143^{b}	142^{b}	138^{c}	137^{c}	1.43	0.0001
HDL, (mg/dl)	49.33^{c}	55.00^{a}	52.67^{b}	54.33^{ab}	56.00^{a}	1.05	0.0007
LDL, (mg/dl)	68.40^{a}	52.87^{b}	52.47^{b}	50.13^{bc}	47.00^{c}	2.19	0.0001
TAC, (mg/dl)	395^{e}	453^{b}	436^{d}	444^{c}	473^{a}	2.48	0.0001
GSH, (U/L)	965^{c}	987^{ab}	985^{b}	990^{ab}	992^{a}	3.08	0.0001
MDA, (mg/dl)	1.22^{a}	0.858^{b}	0.890^{b}	0.883^{b}	0.889^{b}	0.041	0.0001

^{a,b,c} means having different superscripts in the same row are significantly different ($P<0.05$).

SEM: standard error of means, P value: probability level.

Table (8): Effect of vitamin E, commercial silymarin and grind aerial parts of milk thistle plant (Silybum marianum) on blood hematology and immune indices of Gimmizah cockerels reared under summer condition

Criteria	Control	VE[1]	SIM[2]	MTh[3] 12.5 g/kg diet	MTh[3] 25 g/kg diet	SEM	P Value
RBCs, $x10^6/mm^3$	1.31^{c}	1.73^{ab}	1.59^{b}	1.83^{ab}	1.99^{a}	0.1153	0.0061
Hemoglobin, g/dl	9.17^{c}	10.80^{b}	10.57^{b}	11.30^{ab}	12.03^{a}	0.4901	0.0080
Packed Cell Volume, %	30.33^{b}	33.87^{a}	33.13^{a}	34.50^{a}	35.30^{a}	0.9933	0.0147
WBCs, $x10^3/mm^3$	21.34^{b}	25.27^{a}	24.27^{a}	25.63^{a}	26.07^{a}	0.8097	0.0060
Lymphocyte, %	43.07^{b}	45.77^{a}	45.23^{a}	46.30^{a}	46.53^{a}	0.7759	0.0248
Monocyte, %	15.57	14.83	15.17	15.63	15.00	0.3828	0.2735
Eosinophil, %	11.42	11.17	11.19	11.29	11.21	0.2877	0.0707
Heterophil, %	27.95^{a}	26.23^{ab}	26.41^{ab}	24.78^{b}	25.25^{b}	0.8556	0.0495
H/L ratio	0.650^{a}	0.573^{b}	0.585^{b}	0.536^{b}	0.543^{b}	0.0283	0.0375
Phagocyte Activity, %	16.10^{b}	18.93^{a}	18.33^{a}	19.37^{a}	19.67^{a}	0.6901	0.0136
Phagocyte Index, %	1.33^{b}	1.63^{a}	1.58^{a}	1.69^{a}	1.72^{a}	0.0883	0.0350

^{a,b,c} means having different superscripts in the same row are significantly different ($P<0.05$).

SEM: standard error of means, P value: probability level.

VE: Vitamin E. SIM: Commercial silymarin. MTh: Milk thistle plant.

Table (9): Effect of vitamin E, commercial silymarin and grind aerial parts of milk thistle plant (Silybum marianum) on economical efficiency (EE) and relative economical efficiency (REE) of Gimmizah cockerels reared under summer condition at the end of experiment

Criteria	**Control**	**VE[1]**	**SIM[2]**	**MTh[3]**	
				12.5 g/kg diet	**25 g/kg diet**
Total feed Intake[1], (Kg)	4.10	4.41	4.39	4.45	4.56
Cost of Kg feed [2],(LE)	4.9	5.2	5.4	5.28	5.65
Chick cost at 21 day, (LE)	10	10	10	10	10
Total cost, (LE)	30.09	32.95	33.69	33.48	35.77
Body weight, (kg)	1.253	1.426	1.374	1.429	1.496
Market Price[4], (LE)	40.096	45.632	43.968	45.728	47.872
Net Revenue [5], (LE)	10.01	12.68	10.28	12.25	12.10
EE[6]	0.33	0.38	0.31	0.37	0.34
REE[7], %	100	115.2	93.9	112	103.0

VE: Vitamin E. SIM: Commercial silymarin. MTh: Milk thistle plant.

1-Total Feed Intake (Kg)= feed intake during the experimental period (70 days).

2- Price of Kg diet (assuming that 1 Kg unsupplied diet = 4.9 LE, cost kg of VE = 200 LE, cost of supplied commercial silymarin = 0.50 LE, 1 Kg MTh= 30.0 LE).

3- Total cost (LE) = 1 * 2 + chick cost at 21 day

4- Market Price = BW * 32 LE

5-Net Revenue (LE) = Differences between market price of the bird and total cost.

6-Economic Efficiency (EE) = Net revenue / Total cost

7- Relative economical efficiency (REE), assuming control treatment = 100 %.

Relative Humidity, %

Temperature, °C	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
20	63	63	63	64	64	64	64	65	65	65	66	66	66	66	67	67	67	67	68	[illegible]
22	64	65	65	66	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71	[illegible]
24	66	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73	74	74	75	[illegible]
26	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	77	77	78	78	[illegible]
28	70	70	71	72	72	73	74	74	75	76	76	77	78	78	79	80	80	81	82	[illegible]
30	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	[illegible]
32	73	74	75	76	77	77	78	79	80	81	82	83	84	84	85	86	87	88	89	[illegible]
34	75	76	77	78	79	80	81	82	83	84	84	85	86	87	88	89	90	91	92	[illegible]
36	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	94	95	96	[illegible]
38	78	79	81	82	83	84	85	86	88	89	90	91	92	93	95	96	97	98	99	[illegible]
40	80	81	82	84	85	86	88	89	90	91	93	94	95	96	98	99	100	101	103	[illegible]

Categories of the Livestock Weather Safety Index associated with THI values:
Normal: ≤ 74 Alert: 75-78 Danger: 79-83 Emergency: ≥ 84

Figure (1): Temperature-Humidity Index (THI) chart (based on Thom, 1959). Associated Livestock. Weather Safety Index (LWSI; LCI, 1970) categories are also shown. Gross and Siegel (1983).

REFERENCES

Abou-Shehema, B. M. E. M., 2013. Effect of trimethylglycine (Betaine) with or without some anti-stress substances on the performance of the Mandara laying hens under heat stress condition. PhD. Thesis. Faculty of Agriculture, Damanhour University.

Asghar, Z.;.and Masood, Z., 2008. Evaluation of antioxidant properties of silymarin and its potential to inhibit peroxyl radicals in vitro.Pak. J. Pharm. Sci.,21:249-254

Attia, Y. A.; Böhmer, Barbara, M.; and Roth-Maier D. A., 2006. Responses of broiler chicks raised under constant relatively high ambient temperature to enzymes, amino acid supplementations, or diet density. Archive Für Geflügelkunde., 70, 80-91.

Attia, Y.A.; Hassan, R.A.; Tag El-Din, A.E.; and Abou-Shehema, B.M., 2011. Effect of ascorbic acid or increasing metabolizable energy level with or without supplementation of some essential amino acids on productive and physiological traits of slow-growing chicks exposed to chronic heat stress. J. Anim. Phys. Anim. Nutr. 95:744–755

Ayo, J.O.; Minka, N.S.; and Fayomi, A., 2005. Effects of ascorbic acid on rectal temperature of pullets transported by road during the hot-dry season. Trop J Anim Sci 8:43–48

Ayo, J.O.; Obidi, J.A.; and Rekwot, P. I., 2010. Seasonal variations in feed consumption, hen-day, mortality and culls of Bovans Black chickens," in Proceedings of the 35th Annual Conference of the Nigerian Society for Animal Production, pp. 415–418, University of Ibadan, March 2010.

Ayo, J.O.; Obidi, J.A.; and Rekwot, P.I., 2011. Effects of heat stress on the wellbeing, fertility, and hatchability of chickens in the Northern Guinea Savannah zone of Nigeria: a review. ISRN Vet Sci. doi:10.5402/ 2011/838606

Ayo, J.O.; Oladele, S.B.; and Fayomi, A., 1996. Effects of heat stress on livestock production: a review. Niger Vet J 1(Special Edition):58–68.

Azad, M. A.; Kikusato, M.; Maekawa, T.; Shirakawa, H.; and Toyomizu. M., 2010. Metabolic characteristics and oxidative damage to skeletal muscle in broiler chickens exposed to chronic heat stress. Comp. Biochem. Physiol. A Mol. Integr. Physiol. 155:401–406.

Bhattacharya, S., 2011. Milk thistle (Silybum marianum L. Gaert.) seeds in health. In: Preedy V.R., Watson R.R., Patel V. Editors. Nuts and Seeds in Health and Disease Prevention. 1st Ed., London, Burlington, San Diego: Academic Press (an imprint of Elsevier).

Bollengier-Lee, S.; Williams P.E.; and Whitehead C. C., 1999. Optimal dietary concentration of vitamin E for alleviating the effect of heat stress on egg production in laying hens. Br Poult Sci, 40(1), 102-107. doi: 10.1080/00071669987917

Botsoglou, N.A.; Florou-Paneri, P.; Christaki, E.; Giannenas, I.; and Spais, A.B., 2004. Performance of rabbits and oxidative stability of muscle tissues as affectedby dietary supplementationwith oregano essential oil. Arch. Anim. Nutr., 58: 209–218.

Chand, N.; Muhammad, D.; Durrani, F.; Subhan, Q.; and Ullah, S., 2011. Protective Effects of Milk Thistle (Silybum marianum) against Aflatoxin B1 in Broiler Chicks Asian-Aust. Journal of Animal Science, 24: 1011 – 1018.

Ciftci, M.; Ertas, O. N.; and Guler, T., 2005. Effects of vitamin E and vitamin C dietary supplementation on egg production and egg quality of laying hens exposed to a chronic heat stress. Rev. Med. Vet, 156(2), 107-111.

Cravener, T.L.; Roush, W.B.; and Mashaly, M.M., 1992. Broiler production under varying population densities. Poult. Sci, 71: 427—433.

Daghir, N.J., 2008. Poultry production in hot climates, 2nd ed.. CAB International, Wallinford, Oxfordshire, p: 387.

Das, S.K.; Mukherjee, S.; and Vasudevan, D.M., 2008. Medicinal properties of milk thistle with special reference to silymarin: An overview. Nat. Prod. Rad.; 7: 182-192.

Dei, H. K.; and Bumbie. G. Z., 2011. Effect of wet feeding on growth performance of broiler chickens in a hot climate. Br. Poult. Sci. 52:82–85.

DerMarderosian, A., 2001. The Reviews of natural products. 1st ed. Facts and Comparisons: St. Louis, Missouri.

Duncan, D. B., 1955. Multiple range and multiple F tests. Biometrics, 11:1–42.

Dzenda, T.; Ayo, J.O.; Lakpini, C.A.M.; and Adelaiye, A.B., 2012. Seasonal, sex and live weight variations in feed and water consumptions of adult captive African giant rats (Cricetomys gambianus, Waterhouse– 1840) kept individually in cages. J Anim Physiol Anim Nutr. doi: 10.1111/j.1439-396.2012.01287.x

Feed composition for animal and poultry feed stuff used in Egypt. 2001. Technical pulletil no. Central lab. For Feed and food; Ministry of Agriculture. Egypt.

Fogliano, V.; Verde,V.; Randazzo, G.; and Ritieni, A., 1999. Method for measuring antioxidant activity and its application to monitoring the antioxidant capacity of wines; J. Agric. Food Chem., 47:1035-1040.

Ghazi, S.H.; Habibiyan, M.; Moeini, M.M.; and Abdolmohammadi, A.R., 2012. Effects of dietary selenium, Vitamin E, and their combination on growth, serum metabolites and antioxidant defense system in skeletal muscle of broilers under heat stress. Biological Trace Element Research, 148(3): 322-330.

Gross, W. B.; and Siegel, H. S., 1983. Evaluation of the heterophil/ lymphocyte ratio as a measure of stress in chickens. Avian Dis. 27:972–979.

Hawkey, C.M.; and Dennett, T.B., 1989. A color atlas of comparative veterinary hematology. Wolf Publishing limited, London, England.

Hurwitz, S.; Weiselberg, M.; Eisner, U.; Bartov, I.; Riesenfeld, G.; Sharvit, M.; Niv, A.; and Bornstein, S., 1980. The energy requirements and performance of growing chickens and turkeys as affected by environmental temperature. Poult. Sci. 59:2290–2299.

Keim, S.M.; Guisto, J.A.; Sullivan, J.B. Jr., 2002. Environmental thermal stress. Ann Agric Environ Med 9:1–15

Khan RU, Rahman ZU, Nikousefat Z, Javadi M, Tufarelli V, Dario C, Selvaggi M, Laudadio V (2012) Immunomodulating effects of vitamin E in broilers.World Poult Sci J 68:31–40

Khan, R. U.; Naz, S.; Nikousefat, Z.; Tufarelli, V.; Javdani, M.; Rana, N.; and Audadio, V., 2011. Effect of vitamin E in heat-stressed poultry. Worlds Poultry Science Journal, 67(3), 469-477. doi: 10.1017/s0043933911000511

Kim, I.S.; Yang, M.R.; Lee, O.H.; and Kang, S.N., 2011. Antioxidant activities of hot water extracts from various spices. Int. J. Mol. Sci. 12: 4120–4131.

Kirunda, D.F.; Scheideler, S.E.; and McKee, S.R., 2001. The efficacy of vitamin E (DL-alpha-tocopheryl acetate) supplementation in hen diets to alleviate egg quality deterioration associated with high temperature exposure. Poult. Sci., 80: 1378-1383.

Konca, Y.; Kirkanar, F.; Mert, S.; and Yurtseven, S., 2009. Effect of dietary ascorbic acid supplementation on growth performance, carcass, bone quality and blood parameters in broiler during natural summer temperature. Asian Jour. of Animal and veterinary Advances 4:139-147.

Kreeman, V.; Skottova, N.; and Walterova, D., 1998. Silymarin inhibits the development of diet-induced hypercholesterolemia in rats. Planta Med. 64: 138-142.

Kshirsagar, A.; Ingawale, D.; Ashok, P.; Vyawahare, N., 2009. Silymarin: A comprehensive review. Phcog. Rev. 3: 116-124.

Kshirsagar, M.; Mahash, V.; Srinivas, P.; and Mangala, L., 2013. Evaluation of the protective effect of silymarin on doxorubicin induced chronic testicular toxicity in Rats. International Journal of Pharmacy and Biological Sciences, 4: 473 – 484.

Kusandi, E.; and Djulardi, A., 2011. Physiological dynamics of broilers at various environmental temperatures. Int J Poult Sci 10:19–22

LCI., 1970. Patterns of transit losses. Omaha, Neb.: Livestock Conservation, Inc.

Leijh P.C.; Van Furth, R.; and Van Zwet, T.L., 1986. In vitro determination of phagocytosis and intracellular killing by polymorphonuclear and mononuclear phagocytes. In: Handbook of Experimental Immunology, Weir M.D., Herzenberg L.A., Blackwell C. (eds). Oxford, Blackwell Scientific Publications, pp. 1–21.

Lin, H.; Wang, L.F.; Song, J.L.; Xie, Y.M.; Yang, Q.M., 2002. Effect of dietary supplemental levels of vitamin A on egg production and immune responses of heat-stressed laying hens. Poult Sci 81:458–465

Marai, I.F.M.; Habeeb, A.A.M.; Gad, A.E., 2002. Reproductive traits of male rabbits as affected by climatic conditions, in the subtropical environment of Egypt. Anim Sci 75:451–458

McKee, J.S.; Harrison, P.C.; and Riskowski, G.L., 1997. Effects of supplemental ascorbic acid on the energy conversion of broiler chicks during heat stress and feed withdrawal. Poult. Sci. 76:1278–1286.

Metwally, M.A., 2003. Effect of vitamin E on the performance of Dandarawi hens exposed to heat stress. Egypt. Poult. Sci. J. 23:115–127

Miguez, M.P.; Anundi, I.; Sainz-Pardo, L.A.; Lindrus, K.O., 1994. Hepatoprotective mechanism of silymarin: No evidence for involvement of cytochrome P450 2E1. Chemico-Biological Interactions; 91:51-63.

Muhammad, D.; Chand, N.; Khan, S.; Sultan, A.; Mushtaq, M.; and Rafiullah., 2012. Hepatoprotective Role of Milk Thistle (Silybum marianum) in Meat Type Chicken Fed Aflatoxin B_1 Contaminated Feed. Pak Vet Jour. February 09,2012.

Nicol, C.J.; Caplen, G.; Edgar, J.; and Browne, W.J., 2009. Associations between welfare indicators and environmental choice in laying hens. Anim Behav 78:413–424.

Niu, Z.Y.; Liu, F.Z.; Yan, Q.L.; Li, W.C., 2009. Effects of different levels of vitamin E on growth performance and immune responses of broilers under heat stress. Poultry Sci 88:2101- 2117

Oluyemi, J. A.; and Roberts, F. A., 2000. Poultry Production in Warm Wet Climate. (2ndEd.) Spectrum Books Ltd. Ibadan, Nigeria.

Plyaschenko, S.T.; and Sidorov, V.T., 1987. Stress in farm animals. Agropromizdat, Moscow, 190 pp (in Russian)

Pradhan, S.C.; and Girish, C., 2006. Hepatoprotective herbal drug, silymarin from experimental pharmacology to clinical medicine. Indian J. Med. Res. 124 (5): 491- 504.

Prinzinger, R.; Prebmar, A.; and Schleucher, E.M., 1991. Body temperature in birds. Camp. Biochem. Physiol. Vol. 99A, No. 4, pp. 499-506.

Quarantelli, A.; Righi, F.; Bonomi, A.; Renzi, M.; Bruni, R.; and Schiavone, A., 2004. Impiego della silimarina nell'alimentazione del pollo da carne. Atti. S.I.S.Vet. 58:235-236.

Rajiha, A., 2012. The therapeutic effect of Silybum marianum on the lead acetate induced - reproductive toxicity in both gender laboratory rats. Journal Sciience & Mediiciine 2012 5 (1): 144 – 15.

Rajput, A.B.; Kolte, B.R.; Shisodiya, J.M.; Chandankhede, J.M.; and Chahande, J.M., 2009. Effect of vitamin A, vitamin C, vitamin E and Levamisole on performance of broilers. Vet. World, 2: 225–227.

Rama Rao, S.V.; Nagalakshmi, D.; and Reddy, V. R., 2011. Feeding to minimize heat stress. Available at: http://www.poulvet.com/poultry/articles/feeding _in_summer.

Sahin, K.; Onderci, M.; Gursu, M.F.; Kucuk, O.; Sahin, N., 2004. Effect of melatonin supplementation on biomarkers of oxidative stress and serum vitamin and mineral concentrations in heat-stressed Japanese quails. J Appl Poult Res 13:342–348

Sahin, K.; Sahin, N.; and Yaralioglu, S., 2002. Effects of vitamin C and vitamin E on lipid peroxidation, blood serum metabolites, and mineral concentrations of laying hens reared at high ambient temperature. Biological Trace Element Research, 85(1), 35-45. doi: 10.1385/BTER:85:1:35

SAS, Institute, 1996. SAS User's Guide. Version 6.12. SAS, Institute Cary, NC.

Scott, T. A.; and Balnave, D., 1988. Comparison between concentrated complete diets and self-selection for feeding sexually maturing pullets at hot and cold temperatures. Br. Poult. Sci. 29:613–625

Shaker, E.; Mahmoud, H.; and Mnaa, S., 2010. Silymarin, the antioxidant component and Silybum marianum extracts prevent liver damage. Food Chem. Toxicol. 48 (3), 803- 806.

Shalan, M. G.; Abd, A. W.; and El-Batanony, M., 2006. The protective role of vitamins (C, E), selenium silymarin and rehydran-N against lead toxicity under heat stress conditions. Journal of the Indian Society of Toxicology (JIST). Vol 002 ISSUE 002 joly-Dec 15-22.

Simanek, V.; Kren, V.; Ulrihova, J.; Vicar, J.; and Cvak, L., 2000. New application of Silybin and Silynarin. Hepatology, 32: 442.

Singh, D.P.; Beloy, J.; McInerney, J.K.; and Day, L., 2012. Impact of boron, calcium and genetic factors on vitamin C, carotenoids, phenolic acids, anthocyanins and antioxidant capacity of carrots (Daucus carota). Food Chem 132:1161–1170

Sinkalu, V.O.; Ayo, J.O.; Adelaiye, A.B.; and Hambolu, J.O., 2009. Influence of coadministration of vitamins A and E on diurnal variation in rectal temperature of Black Harco pullets during the hot-dry season. Biol Rhythm Res 40:257–264

Sobolova, L.; Skottova, N.; Vecera, R.; and Urbanek, K., 2006. Effect of silymarin and its polyphenolic fraction on cholesterol absorption in rats. Pharmacol. Res., 53 (2): 104-112.

Sonnenbichler, J.; and Zelt, I., 1986. Biochemical effects of the flavonolignane silibinin on RNA, protein and DNA synthesis in rate livers. Prog. Clin. Biol. Res., 213, 319-331.

Soto, C.; Mena, R.; Luna, J.; Cerbon, M.; Larrieta, E.; Vital, P.; Uria, E.; Sanchez, M.; Recoba, R.; Barron, H.; Favari, L.; and Lara, A., 2004. Silymarin induces recovery of pancreatic function after alloxan damage in rats. Life Sci., 75:2167-2180.

Surai, P.F.; Fujihara, N.; Speake, B.K.; Brillard, J.P.; Wishart, G.J.; and Sparks, N.H.C., 2001. "Polyunsaturated fatty acids, lipid peroxidation and antioxidant protection in avian semen—review," Asian-Australasian Journal of Animal Sciences, vol. 14, no. 7, pp. 1024–1050.

Tatlı Seven, P., 2008. The effects of dietary Turkish propolis and vitamin C on performance, digestibility, egg production and egg quality in laying hens under different environmental temperatures.Asian Australas J Anim Sci 21: 1164-1170

Temim, S.A.; Chagneau, M.; Guillaumin, S.; Mitchel, J.; Peresson, R.; and Tesseraud, S., 2000. Does excess dietary protein improve growth performance and carcass characteristics in heat exposed chickens. Poultry Sci., 79: 312–317.

Thom, E. C., 1959. The Discomfort Index. Weatherwise 12: 57-60.

Valko, M.; Rhodes, C.J.; Moncol, J.; and et al., 2006. Free radicals, metals and antioxidants in oxidative stress-induced cancer. Chemico-Biol Inter. 160:1–40.

Viuda-Martos, M.; Navajasa, Y.R.; Zapata, E.S.; Fernandez Lopez, J.; and Perez-Alvarez, J.A., 2010. Antioxidant activity of essential oils of five spice plants widely used in a Mediterranean diet. Flavour and Fragrance. J. 35:13-19.

Windisch, W.; Schedle, K.; Plitzner, C.; and Kroismayr, A., 2008. Use of phytogenic products as feed additives for swine and poultry. Journal of Animal Science, 86: 140-148.

Wu, J.W.; Lin, L.C.; and Tsai, T.H., 2009. Drug-drug interactions of silymarin on the perspective of pharmacokinetics.J.Ethnopharmacol Ethno Pharm., 121:181- 193.

الملخص العربى

تأثير إضافة السليمارين علي أداء الدجاج المستنبط المربي تحت ظروف الصيف

1- خلال فترة النــمو

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أجريت هذة الدراسة لمعرفة مدي تأثير خلط مسحوق نبات شوك اللبن في علائق الديوك خلال مرحلة النمو كمصدر لمضادات الاكسدة علي تحسين اداء ديوك الجميزة خلال فصل الصيف (من 18 يونيو الى 26 اغسطس 2017) . أستخدم فى هذة الدراسة عدد 125 ديك عمر 21 يوم من سلالة الجميزة. تم وزن الطيور فرديا وقسمت عشوائيا الى خمسة مجموعات تجربية بكل مجموعة خمس مكررات وبكل مكررة عدد 5 ديوك؛ وذلك فى اقفاس تربية بعنبريعمل بالنظام المفتوح حتي نهاية التجربة عند عمر 91 يوم من العمر. أستخدمت المجموعة الأولي كمجموعة مقارنه (كنترول) وتم تغذيتها علي العليقة الأساسية بدون إضافات ،المجموعة الثانية تم تغذيتها علي العليقة الأساسية مضافا إليها 150 ملليجرام فيتامين هـ / كجم علف بوصفها مغذيات مناعية والمجموعة الثالثة تم تغذيتها علي العليقة الأساسية مضافا إليها 0,5 جم سلمارين تجارى / كجم علف. المجموعتين الرابعة والخامسة تم تغذيتها علي العليقة الأساسية مضافا إليها 12,5، 25 جرام مسحوق نبات شوك اللبن /كجم علف علي الترتيب كمصدر طبيعي للسليمارين (تمثل 0,5 و 1,0 جم من السيليمارين). أوضحت نتائج التحليل الكيميائي لنبات شوك اللبن أن النسبة الإجمالية للبوليفينولات ومضادات الأكسدة هي 188,5 و 320 ملليجرام / 100 جرام علي الترتيب. أدت جميع الاضافات الغذائية المختلفة الى تحسن معنوى فى وزن الجسم والزيادة فى وزن الجسم وكمية الغذاء الماكول وكفاءة التحويل الغذائى مقارنة بمجموعة الكنترول وذلك خلال الفترة الكلية للتجربة ؛ اوضحت النتائح أن إضافة مسحوق شوك اللبن بمعدل 25 جرام / كيلوجرام علف حققت أفضل النتائج بالنسبة لوزن الجسم والزيادة فى وزن الجسم. أدت جميع الاضافات الغذائية الى تحسن معنوى فى نسبة التصافى والوزن النسبى للكبد والطحال والخصيتين وغدة البرسا مقارنة بمجموعة الكنترول. إضافة مسحوق شوك اللبن بمعدل 25 جرام /كجم علف أدى إلى تحسن معنوى فى الوزن النسبى للكبد وغدة البرسا مقارنة بالمجاميع الأخري. أدت الاضافات الغذائية المختلفة الى تحسن معنوى فى المقاييس البيوكيمائية للدم مقارنة بمجموعة الكنترول. بصفة عامة فان اضافة مسحوق شوك اللبن (سواء 12,5أو 25 جرام /كجم علف) أدى الى تحسن معنوى فى محتوى الدم من إنزيمات وظائف الكبد ، الدهون الكلية ،الجلسريدات الثلاثية ،الكولستيرول الكلى مقارنة بمجموعة فيتامين هـ أو مجموعة الكنترول. أدت الاضافات الغذائية المختلفة الى تحسن معنوى فى مضادات الاكسدة الكلية ،الجلوتاثيون ،مستوى دليل أكسدة الدهون (المالونالدهيد)، الخلايا الليمفاوية ، الخلايا متعددة الصبغ ، النسبة ما بين الخلايا متعددة الصبغ الى الخلايا الليمفاوية وكذلك النشاط البلعمى ودليل النشاط البلعمى مقارنة بمجموعة الكنترول.

وقد خلصت الدراسة الى ان إضافة 25جرام من مسحوق نبات شوك اللبن لكل كيلوجرام علف (تعادل 1جم سليمارين/كجم علف) خلال شهورفصل الصيف تؤدى الى تحسن فى الصفات الأنتاجية وخصائص الذبيحة والمقاييس البيوكميائية لدم ديوك الجميزة. وقد سجل اضافة مسحوق نبات شوك اللبن بمعدل 12,5 جرام /كجم علف (تعادل 0,5 جم سليمارين/كجم علف) أفضل عائد اقتصادى .