

The Efficacy of Thyme Essence on Internal Organ Weights, Biochemical Traits and Mortality of Broilers Fed Aflatoxin B₁

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Abstract A total of 240 day old chicks were used in a completely randomized design to investigate the effects of Thyme essence, in aflatoxin B₁ contaminated diets on the internal organ weights, biochemical traits and mortality of broilers. Twelve pen replicates with 20 chicks in each pen were assigned into each of the 4 dietary treatments having 3 replicates comprising: 1) basal diet containing; 2) basal diet + 600ppb aflatoxin; 3) basal diet + 500ppb Thyme essence; and 4) basal diet + 600ppb aflatoxin + 500ppm Thyme essence. The addition of aflatoxin to diets reduced spleen weight and increased the liver weight and inclusion of Thyme essence could only restore the increased liver weight. Aflatoxin increased the cholesterol, LDL and HDL levels in the broilers blood and Thyme essence cold partially reduce these increased levels. In conclusion, results of the present study indicated that the Thyme essence is a partially useful effective for reducing the signs of aflatoxin B₁ toxicities in growing broilers.

Keywords Aflatoxin B₁, Thyme Essence, Body Weight, Feed Consumption, FCR, Antibody titers, Broilers

1. Introduction

Aflatoxins, secondary metabolites of various *Aspergillus* spp., commonly pollute a wide variety of tropical and subtropical food/feed stuffs. These mycotoxins are known to have strong hepatotoxic and carcinogenic properties [1]. Chemically, aflatoxins are furanocoumarin mixtures and include B₁, B₂, G₁, G₂, M₁, and M₂. These mycotoxins contaminate a wide variety of agricultural commodities including oilseed meals, dried fruits, spices, and cereals [2]. Among the various types of aflatoxins, aflatoxin B₁ (AFB₁) is most frequently encountered and it is also considered to have higher toxicity than other aflatoxins. A study revealed the impact of low concentrations of aflatoxin, deoxynivalenol (Vomitoxin) or fumonisins in diets on growing pigs and poultry [3]. In this study, they used simple linear regression to summarize different trials from the literature and estimated the relationship between mycotoxin level and for example, growth rate. The researchers estimated that for each additional part per million (ppm) of aflatoxin in the feed, the growth rate of pigs is depressed by 16%. For instance, a level of 0.3ppm aflatoxin in feed would result in a 5% reduction in daily weight gain when compared to a non-contaminated feed. For deoxynivalenol, the

reduction in daily weight gain was estimated at about 8% for each additional ppm. Similarly, it was calculated that growth performance of pigs is reduced by 0.4% for each additional ppm of fumonisins in the diet. Decreased water and feed intake, weight loss, dullness, stunting, ruffled feathers, poor appearance and paleness, trembling, ataxia, lameness, paralysis of the legs and wings gasping, prostration and death are most seen in experimental and natural outbreak of aflatoxicosis in broilers [4]. The most characteristic gross lesions appeared in the livers which were enlarged, pale yellow to grayish brown and had a prominent reticular pattern. The liver, spleen and kidney will increase in size, whereas the bursa of Fabricius and thymus will be decreased [5]. Lethal aflatoxicosis can cause either dark red or yellow discoloration of the liver due to congestion or fat accumulation, respectively. At chronicity livers became shrunken, firm and nodular and gall bladder was distended. The kidneys of affected birds appeared enlarged and congested and the spleen will be enlarged and mottled in appearance [6]. Histopathology of the liver revealed congestion of hepatic sinusoids, fecal hemorrhages, centrilobular fatty cytoplasmic vacuolation and necrosis, biliary hyperplasia and nodular lymphoid infiltration. In the kidney, the epithelial cells of many tubules were vacuolated. Another study reported severe degeneration of hepatocytes, dilation of central veins, bile duct proliferation and lymphocytic depletion in lymphoid organs in field outbreaks of aflatoxicosis in broilers [7]. Several biochemical parameters are affected by aflatoxin exposure [8]. Aflatoxin

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decreases total serum proteins, alpha, beta and gamma globulins, with IgG being more sensitive than IgM [6]. Total serum proteins contents are depressed due to reduced values of alpha and beta globulins and albumen, while gamma globulins are affected more variably. Serum lipoproteins, cholesterol, triglycerides, uric acid and calcium are also decreased [7]. The activity of serum or plasma enzymes has been widely used as a measure of aflatoxin activity in chickens. Increased activities of sorbitol dehydrogenase, glutamic dehydrogenase, lactate dehydrogenase, alkaline phosphatase, acid phosphatase, aspartate aminotransferase and alanine aminotransferase were reported in aflatoxin fed chickens [4]. The rise in the levels of serum enzymes measured was interpreted as a consequence of hepatocyte degeneration and subsequent leakage of enzymes [4]. Aflatoxin treated birds showed decreased fractional excretion of phosphate, total plasma calcium concentration, decreased total plasma proteins, plasma 25-hydroxyl vitamin D and plasma 1, 25-dihydroxy vitamin D. Essential oils are complex compounds, and their chemical composition and concentrations of various compounds are variable [9]. Essential oils basically consist of two classes of compounds, the terpene and phenylpropene, depending on the number of 5-carbon building blocks. The exact antimicrobial mechanism of essential oils is poorly understood. However, it has been suggested that their lipophilic property [10] and chemical structure [11] can play a role. It was suggested that terpenoid and phenylpropanoid can penetrate the membranes of the bacteria and reach the inner part of the cell because of their lipophilicity [12]. Moreover, structural properties, such as the presence of the functional groups [11] and aromaticity are also responsible for the antibacterial activity of essential oils. Various plant extracts, especially essential oils, have been studied for their antimicrobial abilities. Most of researches done in this area have been performed in vitro, but there have been few studies with live poultry flocks. A recent study involving live birds showed that blends of the primary components of the essential oils could be used to control *Clostridium perfringens*, the bacterium that causes necrotic enteritis in broilers [13]. Ground thyme has been shown to inhibit the growth of *S. typhimurium* when added to media. The essential oil of the thyme has been shown to inhibit the growth of the *E. coli* in media [14]. Aromatic plants and essential oil extracted from these plants have been used as alternatives to antibiotics. For this reason, these plants are becoming more important due to their antimicrobial effects and the stimulating effect on animal digestive system [15]. Cinnamon extract inhibits *Helicobacter pylori* at the concentration range of common antibiotics, its antimicrobial properties are mainly related to its cinnamaldehyde (the organic compound that gives cinnamon its flavor and odor) content, followed by eugenol and carvacrol substances. The effect of ground thyme and cinnamon on the performance of broilers was studied by Al-Kassie [16], who found their effect on the live weight gain and the improvement of the health of poultry, in addition to other performance traits, feed conversion ratio

and feed intake. The aim of this study was to find the effect of oil extract from thyme and cinnamon as natural growth promoting substances in broiler chicks. Thyme (*Thymus vulgaris*) is a species of flowering plant in the mint family Lamiaceae, with the main components of Phenols, thymol (40%) and carvacrol (15%). This herb also used customarily for several medicinal purposes: respiratory disease, antimicrobial, anti-nociceptive and etc. [17]. Thymol and carvacrol are the main antibacterial active substances, so this plant can be used instead of commercial antibiotics. A group of scientists reported beneficial value of thyme in poultry industry [15]. Thyme is known in Iran as Shirazian thyme and is a popular medicinal plant in whole country. The active components of thyme are thymol and carvacrol, which are known for their antioxidant and antibacterial properties [18]. The *in vivo* reports on the effect of thyme on blood parameters and immunity are very limited, whereas the benefits of probiotics on the immune system are becoming more widely accepted. The purpose of current study was to investigate the effect of substitution of ground thyme as a phytobiotic and a probiotic. In another study [19], it has been reported the occurrence of a significantly ($P<0.01$) higher carcass yield in broiler chicks fed with the probiotics on the 2nd, 4th and 6th week of age. Moreover, the effect of a mixture of herbal essential oils on growth and internal organ weight of broilers and concluded that there were no significant effects for the dietary treatment on body weight of the broilers at 21 and 42 days.

2. Materials and Methods

This experiment was planned and carried out in the Department of Animal Science, Faculty of Agricultural Sciences, Malayer University, Malayer, Iran with objective of evaluating the performance and immune response of broilers fed with aflatoxin B₁ and Thyme essence.

Experimental design, housing, management and test diet

240 day-old unsexed Ross 308 strain of broiler chicks were wing banded, weighed and randomly spread in a completely randomized experimental design with four treatments and three replications of twenty chicks in each. Each replicate group of chicks was housed in an independent pen, conventional deep litter house. Chicks in all the replicates were kept up to six weeks of age under uniform standard conditions. Brooding was done till three weeks of age. Each pen was fitted with an automatic bell type drinker and a hanging tubular feeder. Chicks were provided *ad libitum* feed and water throughout the study. Feeding of test diets commenced at first day of age and continued till the termination of experiment at six weeks of age. The temperature was maintained at $30\pm1^{\circ}\text{C}$ in the first week and reduced by 2.5°C per week to 21°C . From day one until day 4, the lighting schedule was 24 hour. At days 14-42 the dark time was gradually increased to 4 hour. Diets were prepared to meet the nutrient requirements of commercial broilers during the starter (0-2wks), grower (2-4wks) and finisher

(4-6 wks) periods. The composition of diets was adopted from NRC [20] and is presented in Table 1. The basal diet was formulated using commonly available feed ingredients which were screened for AF prior to the formulation of diets. The Aflatoxin B₁ was procured from Sigma Aldrich, USA and diluted to reach to the required level of administration. The experimental diets were prepared by adding required quantity of aflatoxin to arrive at the levels of 0 and 600ppb of AFB₁. Diets were prepared without addition of aflatoxin and Thyme essence as Control (group 1); 600 ppb Aflatoxin B₁ (group 2); 500ppm of Thyme essence (group 3) and 600ppb Aflatoxin B₁ + 500 ppm of Thyme essence (group 4). The ethanolic extraction of Thyme was prepared as per the instruction given below:

Table 1. Ingredients and composition of the basal diets (as-fed basis, %)

Ingredients (%)	Starting diet (0-2wk)	Growing diet (2-4wk)	Finishing diet (4-6wk)
Corn	59.00	67.36	72.01
Soybean meal	33.74	28.63	24.46
Soybean oil	1.56	0.65	0.56
Calcium carbonate	0.60	0.67	0.63
Dicalcium phosphate	1.41	1.02	0.84
Oyster shell	0.66	0.66	0.63
Common salt	0.30	0.30	0.30
Vit. And Min. Premix ¹	0.50	0.50	0.50
DL-Methionine	0.13	0.06	0.02
Lysine – HCL	0.09	0.14	0.05
Calculated analysis			
ME (Kcal/kg)	2900	2950	3000
Crude protein (%)	20.84	18.43	16.87

¹The vitamin and mineral premix provide the following quantities per kilogram of diet: vitamin A, 10,000 IU (all-trans-retinal); Vit. D3 (cholecalciferol), 2,000 IU; vitamin E, 20 IU (α -tocopherol); vitamin K3, 3.0 mg; riboflavin, 18.0 mg; niacin, 50 mg; D-calcium pantothenic acid, 24 mg; choline chloride, 450 mg; vitamin B12, 0.02 mg; folic acid, 3.0 mg; manganese, 110 mg; zinc, 100 mg; iron, 60 mg; copper, 10 mg; iodine, 100 mg; selenium, 0.2 mg and antioxidant, 250 mg.

Plant material

Collective samples of the aerial parts from *Thymus capitatus* growing wild in Khoramabad region within Lorestan province in Iran were collected during the Sept. 2013. Collected plant materials were dried in the shade, and the plant leaves were separated from the stem, and grounded in a grinder to small particles.

Extraction

Maceration Extraction

The powder of *T. capitatus* (leaves and stems) young flowers was macerated with 70% ethanol (1:20, w/v) at room temperature for 2 days and filtered through a Whatman no.1 filter paper. Other portions of the solvent were added to the marc and the extraction was repeated until the last extract was colorless. The extracts were combined and concentrated under reduced pressure at 65°C, 15 rpm and 90 minutes, using a rotary vacuum evaporator. The crude extract was

then evaporated on a boiling water bath (HANSHIN Scientific Co, South Korea) until a constant weight was obtained to afford the maceration extract.

Steam distillation Extraction

Air-dried of *T. capitatus* leaves were submitted for 3 h to steam distillation using a Clevenger apparatus to produce the essential oil in a yield of 5.6% (w/w). Oil was dried over anhydrous sodium sulfate and after filtration, stored at 4°C until used.

Vaccination schedule

The local office of Iranian Veterinary Organization has proposed the required vaccination which is modulated by the veterinarian of Department of Animal Science, Malayer University, as below:

Vaccination for Newcastle Disease (ND) virus happened three times: first spray at one days old of chicken in breeder farm, second on the 13th day as B₁, BRONHOPEST B₁ SPF (VETERINA, GENERA[®]), Zagreb, Croatia) and (CEVA SANTE ANIMALE, Libourne, France) in drinking water and their booster on 20th day as clone-30 (HIPRAVIAR[®] CLON, Amer, Spain) through drinking water. Vaccination against Bronchitis virus happened in two times as the following: first spray at commencement of the experiment and it's booster in drinking water on the 10th day, both as H-120 (CEVA SANTE ANIMALE, Libourne, France). Vaccination against Infectious Bronchitis (IB) virus happened in two times: first on day 16 and the second on the 23th day, both as Gambo-1 (CEVA SANTE ANIMALE, Libourne, France) in drinking water. The sera were applied to HI test in 28 days, to determine Ab to NDV. In titers lower than 5, the booster B₁, BRONHOPEST B₁ SPF (VETERINA, GENERA[®]), Zagreb, Croatia) was administrated in drinking water for broilers.

Studied parameters

Visceral organ weights

Upon obtaining the permission of Ethical Committee of the University, at the end of the trial, six birds from each replicate which were closed to average weight of each replicate were sacrificed by cutting the jugular vein method and blood samples were individually collected in 10-mL heparinized tubes and stored on ice cubes for further hematology analysis. The visceral were then opened and the thymus, spleen, bursa of Fabricius, liver, kidney and pancreas detached and weighed on digital top pan electronic balance (0.1g accuracy) and the later three weighed on monopan balance (1mg accuracy). The weights were adjusted to one kg live weight (g/kg BW) and treatment wise means were calculated.

Biochemical parameters

From the collected blood samples, serum were separated and analysed for cholesterol, LDL and HDL using automatic analyzer (Boehringer Mannheim Hitachi 704 automatic analyzer, Japan). The methodology and the set of reagents used in respect of each parameter were as per the

recommendations of the manufacturer of the analyzer system. Data are presented as means of each treatment.

Mortality

The number of dead birds in each replicate was recorded to calculate the rate of mortality. The dead birds were subjected to postmortem examination to identify the cause of death. The weekly per cent mortality up to 6th week was computed.

Statistical analysis

The total experimental data were statistically analyzed using the General Linear Model procedure of the Statistical Analysis System (SAS[®]) software (SAS Institute, USA) [21]. Overall data were analyzed using one way ANOVA test. Duncan multiple range test at 0.05 probability level was employed for comparison of the means [22].

3. Results and Discussion

The effects of aflatoxin and Thyme essence on Visceral Organ weights (g/kg live weight): The results of dietary treatments on organ weights of broilers fed AF and Thyme and their combinations on broilers at 42 days of age are shown in Table 2. Results showed that the thymus weights have no statistical differences among all treatment groups and ranged from 4.15 to 4.18 g/kg BW. Spleen weights in both AF fed group (Groups 2 and 4) were decreased significantly ($P<0.05$) which shows the adverse effects of AF on the spleen weight. The THY data on this organ was as good as control group and showed no significant change. In case of bursa of Fabricius, no significant changes were noticed among all treatment groups and could be said that all feed additives had no effects of the weight of this internal organ. Liver weights have been influenced by the treatments and in AF group, a significant ($P<0.05$) increase in the weight of liver has been found. The liver weight, in THY group was as equal as CON and no significant changes were noticed. In AF+THY fed group, the liver weight is decreased to that of control and by comparing this group with AF alone fed group, the weight is significantly decreased ($P<0.05$). In case of Kidney and pancreas weights, no impacts of any of treatment groups have been found and these data remained non-significant for all treatments.

The effects of aflatoxin and Thyme essence on blood biochemical parameters (mg/dL): The results of dietary

treatments on blood biochemical parameters of broilers fed AF and Thyme and their combinations on broilers at 42 days of age are shown in Table 3. Results showed that inclusion of AF in the diet (treatment 2) has increased the cholesterol level of broilers significantly ($P<0.05$), compared with control group and in THY group, this parameter is differed significantly ($P<0.05$) with control group. By comparing the F with AF+THY fed group, the data showed that Thyme essence has decreased the cholesterol level below that of AF group significantly ($P<0.05$) and could be said that Thyme essence has a positive effect on the cholesterol level during aflatoxicosis. The LDL content of AF fed group was increased significantly ($P<0.05$) and restored to some extent by addition of Thyme essence (treatment 4) significantly ($P<0.05$). In Thy alone fed group, the LDL level has been remained no-n significant, when compared with control group. Almost the same trend is found in HDL (mg/dL) content of broilers blood at 42 days stating that in AF fed group, the HDL values is increased significantly ($P<0.05$), when compared with control group. In THY group, the HDL value is remained as equal as control group, but surprisingly, the Thyme essence added to AF (AF+THY) could not restore the increased value of HDL due to aflatoxicosis.

The effects of aflatoxin and Thyme essence on Mortality (%): The results of dietary treatments on weekly mortality of broilers fed AF and Thyme and their combinations on broilers at 42 days of age are shown in Table 4. Results showed that during first week, there was no dead bird in all treatment groups. During the second week, only control group has shown a 1.66% of mortality and other groups remained 0. The rate of mortality for the second week (15-21 days) was found to be 0 in CON, 3.33 in AF fed group, 1.66 in THY and 1.66% in AF+THY group. During the week IV, the data on mortality rate (%) of different treatments were 0, 1.66, 0 and 3.33 in CON, AF, THY and AF+THY fed groups, respectively. At week V, the mortality found in CON was 1.66, AF 1.66, THY 0 and AF+THY 1.66. In the last week of experiment, the mortality for control and Thyme essence fed groups remained zero and in AF fed group was found 6.66 and in AF+THY fed group was found to be 1.66. The overall data on percentage mortality in different groups found to be 3.32, 13.31, 3.32 and 8.31 in CON, AF, THY and AF+THY treatment groups, respectively. This shows that the increased percentage of mortality could be controlled by inclusion of Thyme essence in the diet.

Table 2. Visceral Organ weights (g/kg live weight) of broilers fed Aflatoxin B₁ and Thyme essence (Mean±SE)

Treatment groups	Thymus	Spleen	bursa of Fabricius	Liver	Kidney	Pancreas
CON ¹	4.18±0.24 ^a	1.77±0.04 ^a	1.48±0.08 ^a	27.62±0.58 ^b	7.42±0.18 ^a	4.32±0.34 ^a
AF ²	4.16±0.35 ^a	1.06±0.14 ^b	1.47±0.07 ^a	31.10±0.18 ^a	7.45±0.59 ^a	4.29±0.15 ^a
THY ³	4.15±0.18 ^a	1.61±0.11 ^a	1.49±0.18 ^a	27.82±0.67 ^b	7.39±0.27 ^a	4.32±0.22 ^a
AF+THY ⁴	4.17±0.69 ^a	1.06±0.13 ^b	1.48±1.04 ^a	27.49±0.61 ^b	7.41±0.94 ^a	4.31±0.39 ^a

Mean values within a row with different superscript letters (a, b and c) were significantly different ($p<0.05$). ¹CON (Control), ²AF (Aflatoxin B₁ at 600ppb level), ³THY (Thyme essence at 500ppm level) and ⁴AF+THY (Aflatoxin B₁ and Thyme essence at 600 ppb and 500ppm levels, respectively). SEM: Standard Error of the Means.

Table 3. Biochemical parameters of broilers fed Aflatoxin B₁ and Thyme essence (Mean±SE)

Treatment groups	Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
CON ¹	97.33±0.48 ^d	40.05±0.85 ^c	66.33±0.57 ^b
AF ²	143.52±0.36 ^a	66.52±0.44 ^a	83.29±0.19 ^a
THY ³	105.28±0.13 ^c	41.19±0.39 ^c	65.28±0.41 ^b
AF+THY ⁴	112.39±0.83 ^b	45.29±0.19 ^b	82.59±0.11 ^a

Mean values within a row with different superscript letters (a, b and c) were significantly different ($p < 0.05$). ¹CON (Control), ²AF (Aflatoxin B₁ at 600ppb level), ³THY (Thyme essence at 500ppm level) and ⁴AF+THY (Aflatoxin B₁ and Thyme essence at 600 ppb and 500ppm levels, respectively). SEM: Standard Error of the Means.

Table 4. Mortality rates (%) of chicks fed Aflatoxin B₁ and Thyme essence (Mean±SE)

Treatment groups	Week I (day 7)	Week II (day 14)	Week III (day 21)	Week IV (day 28)	Week V (day 35)	Week VI (day 42)	Total (day 0-42)
CON ¹	0	1.66	0	0	1.66	0	3.32±0.15 ^c
AF ²	0	0	3.33	1.66	1.66	6.66	13.31±0.24 ^a
THY ³	0	0	1.66	0	0	0	1.66±0.04 ^c
AF+THY ⁴	0	0	1.66	3.33	1.66	1.66	8.31±0.22 ^b

Mean values within a row with different superscript letters (a, b and c) were significantly different ($p < 0.05$). ¹CON (Control), ²AF (Aflatoxin B₁ at 600ppb level), ³THY (Thyme essence at 500ppm level) and ⁴AF+THY (Aflatoxin B₁ and Thyme essence at 600 ppb and 500ppm levels, respectively). SEM: Standard Error of the Means.

The findings of present study states that aflatoxin B₁ alter the organ weights of broiler and are in agreement of findings of other researchers across the globe and is in accordance with results of trials conducted by Kubena [23]. T-2 toxin, having irritant effect on the epithelial tissue, mucosal membrane and also having the cytotoxic effect showed increased weights of liver and gizzard in this trial. Lack of much effect on T-2 on the weight of kidney as observed in this study was supported by similar observations made in many previous studies [24]. The improvement in relative weight of pancreas was also observed by Kubena [23]. The liver is the primary target organ of toxins in addition; increases in the relative weights of liver pancreas [23], spleen [25] of broilers fed on aflatoxin contaminated diets have also been reported previously. In poultry, the relative weight of liver was reported to be increased more than any of other organs by the presence of aflatoxin in diet [26]. The increase in relative weight of gizzard may be due to the result of severe inflammation and thickening of the mucosal layer which caused by toxic effects of aflatoxin [27]. The increase in the relative weight of spleen might be a compensatory mechanism for the drop in weight of the bursa of Fabricius [28]. A decrease in of relative weight of bursa of Fabricius in chicken fed of aflatoxin contaminated diet was also reported by Kubena [29] which could be attributed to an immunosuppressive effect of aflatoxin. Blood biochemical parameter changes in chicks fed on aflatoxin contaminated diets in this study were more or less similar to those reported in the literature. Decreases in the serum cholesterol and urea nitrogen [29] have been observed in chicks suffering from aflatoxicosis. The increase in serum enzyme levels noted during aflatoxicosis can be interpreted as the sequelae of hepatocyte degeneration or damage to the cell membrane and subsequent leakage of enzyme into the circulation. Higher doses of extracts from both plants showed better results than low doses. These results showed

that extract oil derived from thyme and cinnamon in broiler diets improved body weight gain, feed intake and feed conversion ratio, which may be due to active materials (thymol) in these plants which are considered as digestion stimulating factors, in addition to their antimicrobial activity against bacteria found in the intestine [7]. Moreover, the improvement of body weight gain and feed conversion are due to the active materials (Cinnamaldehyde and eugenol) found in cinnamon, causing greater efficiency in the utilization of feed, resulting in enhanced growth. There is an evidence to suggest that herbs, spices and various plant extracts have appetite and digestion stimulating properties and antimicrobial effects. These results agree with the work of Lee *et al.* [9], who found that adding the cinnamon to the diet of broilers improved their growth performance. These observations are correlated with the data published by some authors. Unfortunately, reports on the value of oil extracts in poultry nutrition are scarce. This study showed that the supplementation of 200ppm oil extract derived from thyme and cinnamon in broiler diets significantly improved the live weight gain and feed conversion ratio during a growing period of 6 weeks, in addition to decreasing serum cholesterol level and H/L ratio in blood. Thus, oil extract derived from herbal plants could be considered as a potential growth promoter for poultry due to its digestive stimulating and antimicrobial effect.

4. Conclusions

Based on the founded data in this trial and available reports, it could be concluded that the addition of aflatoxin in broiler diet can have a negative impact on the Visceral Organ weights, blood biochemical parameters and mortality of broilers and Thyme essence can be used as natural non-antibiotic feed additive in broiler nutrition. Nevertheless, there is scarcity in the evidence of its beneficial effects in

nutrient digestibility and gut function of broilers fed with aflatoxin and Thyme essence.

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