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USING NATURAL FEED ADDITIVES AS ALTERNATIVE ANTI-MYCOTOXINS IN BROILER DIETS

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ABSTRACT: Five weeks feeding trial using 165 one-day old unsexed Hubbard chicks, was carried out to study the effects of using some natural feed additives as anti-mycotoxins on growth performance, blood parameters and economic efficiency in broilers. Chicks were distributed into five dietary treatments according to diets fed as; (T1) fed basal diet (BD); (T2) fed BD + Peppermint Oil 250 (PO) mg/ Kg; (T3) fed BD + Thyme Oil (TO) 250 mg/ Kg; (T4) fed BD + Biological Anti-toxin (BA) Mycofix® Plus 1.0 g/ Kg and (T5) fed BD + Rice Hulls (RH) 20.0 g/ Kg. Each treatment comprised of 33 chicks in 3 replicates of 11 chicks each.

Results showed no significant differences among all experimental groups in overall (0-5 weeks) live body weight (LBW), and daily weight gain (DWG). Chicks fed (T2) diet presented highest LBW and DWG, compared to other groups. Data of overall (0-5 weeks) daily feed consumption (DFC), showed that birds fed (T3) diet consumed less feed when compared to control group, while birds fed (T2), (T4) or (T5) diets remained significantly similar. Similarly, overall (0-5 weeks) values of feed conversion ratio (FCR) indicated that birds fed (T4) or (T5) diets had worse FCR when compared to those fed (T3), while being significantly similar to those fed control (T1) or (T2) diet. Carcass traits, including lymphoid organs, were not significantly affected by different dietary treatments except gastrointestinal tract length and abdominal fat %. Similarly, experimental treatments had no significant effect on all measured blood plasma parameters. Feeding birds on (T3) or (T5) diet, improved activity of amylase and protease in both stomach and ileum, when compared to feeding birds on control diet (T1). On the other hand, chicks fed (T4) diet showed positive effect on intestinal lactic acid bacteria count. Economic efficiency values were reduced for broilers fed any of experimental diets as compared to those fed control (T1).

Key Words: Natural Anti-Toxins, Enzymatic Profile, Bacteria Count and Broilers.

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In conclusion, it may be suggested that incorporation of (PO, TO, BA or RH) in Hubbard broiler diets, had some beneficial effects on productive performance, with no positive effect on economic efficiency. Besides , using these natural feed additives had clear favorable effect on enzymatic and microbiological profile in small intestine, without adverse effects on liver activity or intestine absorption as revealed by histological examination.

INTRODUCTION

Mycotoxins are structurally diverse compounds produced by filamentous fungi that vary in their chemistry and biological effects (Sudakin *et al*., 2003). Aflatoxin–producing fungi and aflatoxin-contaminated animal feedstuffs are recognized worldwide (Yoshizawa, 1991), usually with adverse implications for poultry production (Moreno-Romo and Suarez-Fernandez, 1986). The problem of mycotoxins, exists in Egypt, and the occurrence of these mycotoxins contamination in various feed stuffs was fairly described (Abdelhamid, 1990). The immune system in poultry is the first target to be influenced by mycotoxins. Immunosuppression can be observed in poultry ingesting aflatoxins at levels below those that cause over symptomatology, and explained, in part, by atrophy of the bursa of Fabricius, thymus, and spleen (Peir *et al*., 1972). The control of mycotoxicosis is based on preventing fungal development in the feedstuffs, and on detoxifying toxin-contaminated feed.

Several nutritional, physical, chemical and biological approaches have been proposed to detoxify mycotoxin contaminated feeds and feedstuffs. Bentonite (Rosa *et al*., 2001 and Kermanshahi *et al*., 2009), hydrated sodium calcium aluminosilicate (Scheideler, 1993; Jindal *et al*., 1994), Zeolite (Miazzo *et al*., 2000), activated charcoal (Edrington *et al*., 1997), inorganic sorbents (Baily *et al*., 1998). Live yeast, Sacchromyces cerevisiae, (Celik *et al*., 2001; Aravind *et al*., 2003) was found to alleviate the adverse effects of aflatoxins in poultry. As organic natural product, esterified glucomannan (cell wall derivative of *Sacchromyces cerevisiae*), have shown considerable binding ability with several commonly occurring mycotoxins (Devegowda & Murthy, 2005) and is also found beneficial as a low-inclusion binder in minimizing the adverse effects of aflatoxins present in contaminated livestock and poultry feeds (Raju and Devegowda, 2000; Dvorska and Surai, 2001; Aravind *et al*., 2003; Karaman *et al*., 2005; Girish and Devegowda, 2004).

Anti-microbial and anti-oxidative properties of essential oils and various extracts from many plants have recently been of great interest in both research and the food industry, because their possible use as natural additives emerged from a growing tendency to replace synthetic antimicrobial and antioxidant agents with natural ones (Rasooli *et al*., 2006). In addition, Ahmed *et al*., (2014) stated that, aromatics plants have traditionally been used to extend shelf life of foods, showing inhibitory effect against bacteria, fungi and yeasts. Also, extracts of some medicinal herbs have been shown to counteract deleterious effects of mycotoxins in rats (Hassan *et al*., 2010). In the same way, many scientific efforts have been conducted to use herb or natural plants (green tea, cinnamon, chamomile, ginger and black pepper) to detoxify mycotoxins (Abdelhamid *et al*., 2002; Ibrahim, 2004; Suzuki *et al*., 2006). Coriander, black seed, liquorice, garlic, onion, fenugreek seeds, basil seeds and roquette seeds were also used (Salem *et al*., 2010 and El-Dakar *et al*., 2005). The use of natural antimicrobial compounds, is important not only in the preservation of food but also in the control of human and plant diseases of microbial origin (Baratta *et al*., 1998). The essential

oil of thyme and its major component, thymol, showed a strong inhibitory antifungal activity effect against plant, animal, and human pathogenic fungi from different varieties (Couladis *et al*., 2004). Examination of various concentrations of thyme essential oils on a potentially active fungal strain showed promising prospectus on utilization of natural plants oils as natural anti-mycotoxin (Rasooli and Abyaneh, 2004). Feed additives like phenolic compounds and plant extracts can be useful to reduce toxic effects observed with feed spoiled with mycotoxins (Dvorska *et al*., 2007; Nahm, 1995). In addition to thyme oil, many investigators successfully used other essential oils such as cinnamon, peppermint and basil to protect maize kernels against aflatoxin infection, without affecting germination and corn growth (Montes-Belmont and Carvajall, 1998).

As a biological product, several studies have revealed that esterified glucomannan derived from cell wall of Saccharomyces cerevisiae (Girish *et al*., 2008) have shown considerable promise in countering aflatoxins. Studies of using biological mycotoxin Mycofix®, showed that using Mycofix® in contaminated feeds was responsible for reducing liver residual aflatoxin levels (Gargees and Shareef, 2009), and in ameliorating the negative effect of aflatoxins on Newcastle antibody production (Gargees and Shareef, 2008). Mycofix Plus is a product of Biomin® GmbH, Austria. Mycofix® Plus originally contained: synergistic blend of minerals, biological constituent, BBSH 797, phytogenic substances, and phycophytic constituents (Mycofix® Plus, 2000). Mycofix®, was effectively used in poultry for amelioration of ochratoxicosis and aflatoxin due to the dual mode of adsorption of mycotoxins with suitably located polar functional groups like aflatoxins by selective blend of minerals (Garcia *et al*., 2003), and for alleviation of T-2 toxicosis (Zahir, 2005), aflatoxin inducing coccidiosis (Al-Sbawi, 2005).

Sorbent compounds can be part of an integrated approach (Phillips *et al*., 2002). Bentonite clay would ameliorate aflatoxicosis, and aflatoxin-induced reduction in antibody production (Voss *et al*., 1993; Ibrahim *et al*., 2000). In the same manner, silica-containing compounds are practical and economical feed additives and can reduce the effects of aflatoxin (Kubena *et al*., 1987). Accordingly, rice hulls was used as natural anti-mycotoxin to detoxify aflatoxin contaminated broiler diets (Arafa, 2014). Authors reported that 2.5% rice hulls successfully ameliorated negative effects of aflatoxins on birds and improved broiler performance, with no adverse effects on blood constituents. Furthermore, Arafa *et al*., (2012) reported that using rice hulls at 2.5 % in low-level aflatoxin (naturally contaminated) diets, had no adverse effects on bird performance or carcass traits.

The present study aimed to investigate the anti-mycotoxin capacity of some natural feed additives, i.e., thyme oil and peppermint oil, biological anti-mycotoxin Mycofix® and raw rice hulls, and their effects on broiler performance, carcass traits, blood biochemistry and histological examinations.

MATERIALS AND METHODS

Experimental diets and birds: The present study was carried out at the Poultry Production Unit, Faculty of Agriculture Farm, Qanater, Qaluobia. A total of 165 unsexed one day old Hubbard broiler chicks with average weight 43 g were randomly distributed into 5 treatments. Each treatment comprised of 33 chicks which were divided into 3 replicates of 11 chicks each. The chicks were reared up to 5 weeks of age on litter in floor pens. Five dietary formulations were made using a basal diet; control group fed (T1) basal diet (BD); (T2) BD + Peppermint (*Mentha*

piperita) Oil (PO) 250 mg/ Kg; (T3) BD + Thyme (*Thymus vulgaris*) Oil (TO) 250 mg/ Kg; (T4) BD + Biological Anti-Toxin (BA) (Mycofix® Plus) 1.0 g/ Kg and (T5) BD + Rice Hulls (RH) 20.0 g/ Kg. Mycofix® Plus is the product of Biomin® GmbH., Austria. Mycofix® Plus originally contained: blend of synergistic minerals, biological constituents, phytogenic substances and phycophytic constituents.

Basal diets listed in Table (1), were formulated to ensure sufficient supply of nutrients suggested by guidebook of Hubbard broilers to be isocaloric and isonitrogenous according to NRC (1994) and all feed mixtures were offered in mash form. Table (2) presents different dietary treatments according to additives used across the present study during both starter and grower phases. All chicks were reared under similar environmental, managerial and hygienic conditions. Feed and water were provided ad libitum and initial live body weight values had no significant ($P>0.05$) differences among all tested groups. All chicks were vaccinated by drinking-water-based vaccination against Newcastle and Gumboro diseases. All vaccines were purchased form Veterinary Serum and Vaccine Research Institute, Cairo. Mean body weights and feed consumption per pen were recorded at the end of starter and grower periods namely; at 21 and 35 day of age, respectively. In the same manner, body weight gain and feed conversion ratio (feed/ gain) were calculated at the same age.

Growth Performance: Live body weight (LBW) of each replicate was recorded weekly in the early morning. The body weight gain (BWG) was calculated per replicate by subtracting the initial body weight of a bird in a certain week from the final one in the same week. Average of daily feed consumption (DFC) was calculated from the difference between the weekly amount of feed provided for each replicate within treatments and the residual quantity for the same replicate. Feed conversion ratio (FCR) was calculated in different stages as the amount of feed consumed, in grams, in a certain stage which is required to produce out one gram of weight gain in the same stage, namely (g feed/ g gain).

Blood plasma parameters, intestinal enzymology and microbiology: At 35 days of age, three birds from each treatment having body weight around the average of that treatment, were selected and sacrificed by severing both the carotid artery and the jugular vein. Blood samples were collected simultaneously with slaughtering. Then, blood samples were immediately centrifuged at 3000 rpm for 10 minutes to separate plasma which were kept in deep-freezer until further analysis. Determination of blood plasma parameters included the following: total protein (Gornall *et al*., 1949); albumin (Doumas *et al*., 1971); globulin (determined by subtraction the value of albumin from the respective value of total protein for the same plasma sample); creatinine (Bartles *et al*., 1972); total cholesterol (Richmond, 1973); aspartate aminotransferase (AST) and alanine aminotransferase (ALT) (Reitman and Frankel (1957). All biochemical analyses of blood plasma were determined colorimetrically using commercial diagnosing kits (Bio-Diagnostics® Egypt). Content of intestinal tract were collected to determine the microbiological flora in (microbiological laboratory of MERCIN, faculty of agriculture, Ain Shams University) for enumeration of total bateria, E. Coli and Lactobacilli *spp*. Segments of intestine were collected to determine the enzymes activity by method of Osman (1982) for amylase and Malik and Singh (1980) for protease.

Histological samples: Liver and ileum specimens of the slaughtered birds from

each treatment were fixed in 10% buffered neutral formalin and then dehydrated, cleared and embedded in paraffin wax cubes. Paraffin sections obtained at 4-5 μm and routinely stained with Haematoxyline and Eosin (Bancroft *et al*., 1996).

Carcass traits: After slaughtering, bleeding and scalding, viscera were removed manually without disrupting of abdominal fat. Dressed carcasses, giblets and lymphoid organs were weighed independently prior to immersing in cold water. The dressing percentage DP was calculated by determining carcass weight as a percent of live weight as follows: Dressing percentage = dressed weight / pre-slaughter weight × 100.

Economic evaluation: The economic efficiency (EE) traits were calculated according to North (1981) in relation to the price of local market at the time of the experiment. Performance index (PI) was calculated according to North (1981), while, production efficiency factor (PEF) was calculated according to Emmert (2000).

Statistical analysis: Pen means were the experimental unit for all obtained data. Data were subjected to one way ANOVA analysis of variance, General Linear Model (GLM) by applying the procedure of SAS software SAS (1998) user's guide according to the following model:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where; μ = overall mean, T_i = dietary treatment, e_{ij} = experimental error. Individual effects of dietary treatments were compared using Duncan (1955) multiple range tests at α level equal to 0.05 or 0.01.

RESULTS AND DISCUSSION

Growth performance: Results presented in Table (3) showed no significant (P>0.05) differences among groups fed different dietary treatments in live body weight (LBW) and daily weight gain (DWG) values during either starter or grower phases. Similarly, values of overall LBW, DWG showed no significant (P>0.05) differences among groups fed different diets. The corresponding values for LBW ranged between 1846 g and 1771 g, while DWG ranged between 51.69 g and 49.35 g. Daily feed consumption (DFC) values presented in Table (3) showed no significant (P>0.05) differences among different groups during starter phase. Conversely, overall values of DFC indicate that birds fed (T1) diet consumed significantly (P≤0.05) more feed than those fed (T3) diet. Whereas, birds fed either (T2), (T4) or (T5) diets, consumed notably similar amounts of feed throughout the experimental period (0-5 weeks). The increase in feed consumption was more pronounced during grower period (4-5 wk) being 9.9%, while it was only 1.5% during starter period (0-3 wk). Feed conversion ratio (FCR) values shown in Table (3) demonstrated worse (P≤0.05) FCR with birds fed T5, (1.36) diet during starter phase. Similarly, overall value of FCR was worse (P≤0.05) with birds fed T4, (1.56) or T5, (1.58) diets when compared only with those fed T3, (1.46) diet, while being matching those fed T1, (1.55) or T2, (1.50) diets. These results were in disagreement with those of Arafa *et al*., (2012) who stated that feeding growing chicks 2.5% rice hulls presented better FCR compared to control group. In addition, obtained results were in partial agreement with those of Shebl *et al*., (2010) who declared that feed intake and FCR were not affected by using Hydrated Sodium Calcium Aluminosilicate (HSCAS) as anti-mycotoxin in broilers.

Carcass traits: Data of carcass characteristics at the end of 5th week of age are shown in Table (4). In regard to dressing percentage (DP) and ready-to-cook percentage (RC), no significant (P>0.05) differences were observed in their

values between all treatments ranged between 67.53% and 68.67% & 71.89% and 73.12% for (T5) and (T1), respectively. As of DP and RC values, most of carcass traits, including lymphoid organs, did not imply any significant (P>0.05) differences among all experimental treatment. Abdominal fat presented higher (P≤0.05) values with birds fed (T3) compared to other treatments including those fed the basal diet, (T1). Regarding gastrointestinal tract (GIT) length, it was clear that birds of the control group have shorter (P>0.05) GIT length when compared to those fed different dietary treatments. These results were in agreement with those of Arafa *et al*., (2012) who stated that using 2.5% rice hulls presented similar DP compared to the control group.

Blood plasma parameters: Table (5) shows values of some blood plasma parameters at 5 weeks of age. These data indicated that using of feed additives in the present study had no significant (P>0.05) effects on all measured parameters. Although all values of plasma parameters had no significant differences, some parameters had showed some numerical variations. For example, A/G ratio in all dietary treatments appeared to be decreased, and this means that immunity of birds fed different natural additives, was improved compared to the control group. Concerning creatinine values, which reflects kidney function, results elucidated that (T2) or (T4) have improved kidney function compared to the control and other treatments. Regarding lipid metabolism, results showed that (T2) and (T4) were similar to the control, but (T3) and (T5) increased plasma cholesterol concentration. Concerning liver function, AST activities showed that (T2) was close to control, while values were decreased with birds fed (T3), (T4) or (T5) diets. Also, ALT activity for birds fed (T2) or (T4) diet showed the same concentration as those of control group, but have increased for birds fed (T3) or (T5) diet. This means that using natural anti-mycotoxin increased liver activities without any adverse effect. These results are generally in agreement with those of EL-Faham, *et al*. (2014) who reported that feeding different natural additives (biostrong, probiotics or pungent substances) insignificantly affected most of blood parameters of broiler chicks. Conversely, Ragab (2012) indicated that, feeding different levels of some natural additives with or without enzyme supplementation, had significantly affected ALT, total protein and globulin. Moreover, Abd El-Latif *et al*. (2002) indicated that adding herbs to Japanese quail diets increased plasma total protein as well as albumin and globulin at 6 weeks of age. These results agreed with Denli and Okan (2006) who stated that addition of HSCAS in broiler diets prevented increase in the activity of AST.

Intestinal enzymology: Data in Table (6) indicated that activity of amylase and protease enzymes in ileum were significantly (P<0.01) increased by feeding different dietary treatments. As shown in Table (6), it is remarkable to state that chicks fed different additives (T2: T5) maintained activity of both amylase and protease compared to those fed the control diet (T1). While, responses of chicks fed (T3) or (T5) diet presented higher enzyme activity compared to those fed (T2) or (T4) diet. Similarly, Ahmed *et al*. (2011) reported that amylase and protease activity significantly increased upon feeding diets contained 0.2% black seed oil. In addition, herbal dried leaves or essential oils of plant extracts, presented digestibility enhancer, balanced gut microbial ecosystem and stimulated secretion of digestive enzymes (Lovkova *et al*., 2001; Williams and Losa 2001; Cross *et al*., 2007 and Ahmed *et al*., 2014).

Intestinal microbiology: The data presented in Table (7) and Figure (1) show the effect of different dietary treatments on total viable bacteria, coliform and lactic acid bactreia counts in small intestine (mean log 10 CFU/ g). Lowest value of mean log CFU/ g of total bacteria was recorded for broiler fed (T3) compared to those fed the control diet. In addition, lowest value of mean log CFU/ g of coliform bacteria was recorded for broilers fed (T5) compared to those fed other diets. Moreover, feeding (T4) diet showed positive effect on lactic acid bacteria counts. Chicks fed (T5) or (T1) diet showed similar counts log CFU/ g lactic acid bacteria (4.03 and 4.02 respectively). Similar results were reported by Abou-Sekken *et al*. (2007) who reported that counts of E. coli and molds as well as total bacterial count were significantly reduced by feeding diets containing 0.5% or 1.0% mixture of fennel seeds and thyme leaves in both ileum and caecum of ducks compared to other tested groups. In addition, Ragab *et al*. (2013) reported that chicks fed diets contained 2% fennel seeds had lower total bacteria count as compared to other treatments. In this respect, Cowan (1999) reported that plants are rich in a wide variety of secondary metabolites, such as terpenoids, which was found to have antimicrobial properties.

Histological examination: Liver of chickens from control, and different dietary treatments revealed no histopathological changes (Figure 2). T3, T4 and T5 have improved size of central vein and hepatocytes arrangement than other treatments. Liver sections showed normal hepatic parenchyma. Chickens fed T3, T4 or T5 diets showed less dark stained lymphocytic cells aggregations surrounding or near the central veins. Lymphocytic cells represent immunosystem in birds. Different dietary treatments have increased the length of villi compared with the control group. Also, all layers of intestine section have improved by different dietary treatments especially mucosa layer that contained crypts of Lieberkühn (Figure 3). Villi revealed increased in length for chickens fed T4 or T5 compared with other treatments and the control group. This increment supported the enzymatic activity improved by different dietary treatment. Finally, the above mentioned histological observations support productive performance where dietary treatments have been improved without any adverse effect on liver and intestine histology. These results agree with those of Denli and Okan (2006) who stated that addition HSCAS in broiler diets prevented the histopathological changes induced by aflatoxins.

Economic efficiency: As of data representing feed cost (Table 8), it is generally observed that birds fed (T4) or (T5) diet have been less costly compared to those fed (T1), (T2) or (T3) diet. Regarding total return values, it was noticed that birds fed (T2) diet gave apparently similar value when compared to those fed (T1) diet and higher values when compared to all other groups. Likewise, all tested groups showed parallel economic efficiency, compared with those fed the control diet throughout the trial period (0-35 days). Results of relative economic efficiency indicated that all birds were worse than those fed the control (T1) diet. These results disagree with those of Ragab (2012) who concluded that, dried parsley or peppermint leaves in diets of Hy-line W-36 male chicks had no beneficial effects on the productive performance, while had beneficial effects on economic efficiency. On the other hand, values of performance index showed that birds fed (T2) or (T3) diet have been significantly superior ($P \leq 0.01$) when compared to those fed (T5) diet, while birds fed (T4) diet appeared notably parallel to those fed control (T1) diet. Also, results of production efficiency factor showed that birds fed (T3) diet were significantly superior ($P \leq 0.05$) when

compared to those fed (T5) diet. while birds fed (T2) or (T4) diet appeared remarkably matching to those fed control (T1) diet. Results of economic efficiency were in partial conformity with those of Arafa *et al*., (2012) who stated that feeding growing chicks 2.5% rice hulls presented similar economic efficiency compared to those of control group.

CONCLUSION

In conclusion, it may be suggested that incorporation of Peppermint Oil, Thyme Oil, Biological Anti-toxin or Rice Hulls in Hubbard broiler diets, had some beneficial effects on productive performance, with no favorable effect on economic efficiency. Besides , using these natural feed additives had clear favorable effect on enzymatic and microbiological profile in small intestine without any adverse effect on liver, further studies are suggested to elaborate the effects of these natural feed additives.

Table (1): Feed ingredients and chemical composition of basal diets

Ingredients	Dietary Treatments	
	Starter (0-3 Weeks)	**Grower (3-5 Weeks)**
Corn (grains)	46.45	54.44
Soybean Meal (44%)	36.20	30.15
Full-Fat Soybeans	9.00	9.00
Sunflower Oil	1.83	1.00
Soybean Oil	1.83	1.00
Calcium Carbonate	1.60	1.48
Mono-calcium Phosphate	1.85	1.68
Premix	0.30	0.30
Choline Chloride	0.13	0.13
Salt (NaCl)	0.40	0.40
DL- Methionine	0.34	0.20
HCL Lysine	0.08	0.22
Total	100	100
Chemical composition (Calculated)		
CP %	23.12	21.13
ME Kcal/ Kg diet	3071	3045
Ca %	1.02	0.93
Available P %	0.50	0.46
Lysine	1.39	1.39
Methionine + Cystein	1.06	0.88
Price/ Ton (L.E.)	3775	3468

Each 3 Kg of premix contains: Vitamins: A: 12000000 IU; Vit. D3 2000000 IU; E: 10000 mg; K3: 2000 mg; B1:1000 mg; B2: 5000 mg; B6:1500 mg; B12: 10 mg; Biotin: 50 mg; Coline chloride: 250000 mg; Pantothenic acid: 10000 mg; Nicotinic acid: 30000 mg; Folic acid: 1000 mg; Minerals: Mn: 60000 mg; Zn: 50000 mg; Fe: 30000 mg; Cu: 10000 mg; I: 1000 mg; Se: 100 mg and Co: 100 mg

Table (2): Feed additives to basal diets, as distributed on experimental groups

Feeding Phase	Items	Dietary Treatments				
		1	2	3	4	5
Starter (0-21 days)	Additives	-	PO 250 mg / Kg	TO 250 mg / Kg	BA 1.0 g / Kg	RH 20.0 g / Kg
	Price/ Ton (L.E.)	3775	3925	4025	3789	3781
Grower (21-35 days)	Additives	-	PO 250 mg / Kg	TO 250 mg / Kg	BA 1.0 g / Kg	RH 20.0 g / Kg
	Price/ Ton (L.E.)	3468	3618	3718	3482	3474

T1: basal diet (BD), T2: BD + Peppermint Oil (PO) 250 mg/ Kg; T3: BD + Thyme Oil (TO) 250 mg/ Kg; T4: BD + Biological Anti-toxin (BA) Mycofix® Plus 1 g/ Kg and T5: BD + Rice Hulls (RH) 20 g/ Kg.

Table (3): Effect of different dietary treatments on productive performance, (0 - 5 Weeks)

Items	Dietary Treatments					
	1	2	3	4	5	Sig.
Live body weight (g)						
3 weeks	882.73 ±9.71	866.14 ±1.96	855.00 ±10.23	857.50 ±19.28	860.91 ±7.34	NS
5 weeks	1846.00 ±5.66	1848.82 ±35.32	1815.32 ±32.98	1803.18 ±11.49	1771.41 ±29.57	NS
Daily weight gain (g)						
0–3 weeks	39.93±0.40	39.36±0.03	38.63±0.41	38.72±0.86	38.80±0.38	NS
4–5 weeks	68.81±0.28	70.19±2.66	68.59±1.62	67.54±0.55	65.18±1.58	NS
0–5 weeks	51.48±0.12	51.69±1.04	50.62±0.89	50.25±0.29	49.35±0.86	NS
Daily feed consumption (g)						
0–3 weeks	50.52±2.46	52.51±0.10	49.75±0.59	52.26±0.15	52.90±0.13	NS
4–5 weeks	123.62^{a}±3.01	117.72^{ab}±0.04	111.39^{b}±3.46	117.13^{ab}±1.57	116.02^{b}±0.74	*
0–5 weeks	79.76^{a}±2.68	77.39^{ab}±0.08	74.40^{b}±1.74	78.20^{ab}±0.72	78.15^{ab}±0.21	*
Feed conversion ratio (g feed/ g gain)						
0–3 weeks	1.26^{b}±0.04	1.28^{ab}±0.01	1.28^{ab}±0.01	1.35^{ab}±0.02	1.36^{a}±0.01	*
4–5 weeks	1.80^{a}±0.05	1.68^{ab}±0.06	1.62^{b}±0.01	1.73^{ab}±0.03	1.78^{a}±0.03	*
0–5 weeks	1.55^{ab}±0.04	1.50^{ab}±0.02	1.46^{b}±0.01	1.56^{a}±0.01	1.58^{a}±0.02	*

[a, b] Means within the same row with different superscripts are significantly different. Sig. = Significance * ($P \leq 0.05$). NS = Non Significant.

(T1): basal diet (BD), (T2): BD + Peppermint Oil 250 mg/ Kg; (T3): BD + Thyme Oil 250 mg/ Kg; (T4): BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg and (T5): BD + Rice Hulls 20 g/ Kg.

Table (4): Effect of different dietary treatments on carcass characteristics, (35 days of age)

Items	**Dietary Treatments**					
Carcass Characteristics	**1**	**2**	**3**	**4**	**5**	**Sig.**
Live Body weight (g)	1901.25 ±78.13	1895.00 ±21.11	1821.75 ±10.27	1800.00 ±26.69	1893.25 ±5.89	NS
Carcass weight (g)	1304.75 ±46.60	1286.75 ±39.91	1231.00 ±23.94	1224.75 ±5.94	1278.25 ±25.56	NS
Dressing %	68.67±0.71	67.87±1.64	67.57±1.23	68.11±1.31	67.53±1.52	NS
Liver %	2.67±0.18	2.28±0.15	2.33±0.14	2.28±0.11	2.35±0.08	NS
Gizzard %	1.25±0.06	1.15±0.10	1.35±0.01	1.18±0.17	1.43±0.09	NS
Heart %	0.51±0.02	0.59±0.07	0.61±0.07	0.46±0.02	0.57±0.06	NS
Giblets % *	4.44±0.17	4.03±0.17	4.30±0.22	3.92±0.15	4.36±0.22	NS
Ready to cook % #	73.12±0.81	71.91±1.55	71.88±1.04	72.04±1.18	71.89±1.32	NS
Abdominal Fat %	1.18^{ab}±0.29	0.98^{ab}±0.28	1.56^{a}±0.06	0.69^{b}±0.10	0.98^{ab}±0.26	*
GIT length (cm)	136.25^{b} ±4.73	156.75^{a} ±3.14	145.00^{ab} ±7.34	163.75^{a} ±5.17	158.00^{a} ±7.44	*
Lymphoid Organs:						
Spleen %	0.13±0.03	0.10±0.01	0.13±0.01	0.09±0.01	0.15±0.03	NS
Thymus %	0.55±0.06	0.40±0.01	0.44±0.06	0.47±0.07	0.57±0.06	NS
Bursa %	0.07±0.02	0.12±0.03	0.09±0.01	0.06±0.01	0.08±0.02	NS

$^{a, b}$ Means within the same row with different superscripts are significantly different. Sig. = Significance * ($P \leq 0.05$). NS = Non Significant. GIT = gastrointestinal tract; * Giblets = Liver + Gizzard + Heart, # Ready to cook = Carcass Weight + Giblets
(T1): basal diet (BD), (T2): BD + Peppermint Oil 250 mg/ Kg; (T3): BD + Thyme Oil 250 mg/ Kg; (T4): BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg and (T5): BD + Rice Hulls 20 g/ Kg.

Table (5): Effect of different dietary treatments on blood plasma parameters, (35 days of age)

Items	Dietary Treatments					
Plasma Parameters	**1**	**2**	**3**	**4**	**5**	**Sig.**
Total Protein (g/ dl)	6.43±0.43	6.94±0.60	6.60±0.52	6.18±0.29	7.42±0.36	NS
Albumin (g/ dl)	4.15±0.24	3.62±0.19	3.55±0.08	3.52±0.11	3.93±0.27	NS
Globulin (g/ dl)	2.28±0.42	3.32±0.57	3.05±0.45	2.65±0.39	3.48±0.58	NS
A/ G ratio #	2.05±0.47	1.19±0.23	1.26±0.22	1.45±0.28	1.25±0.27	NS
Creatinine (mg/ dl)	1.29±0.38	0.94±0.20	1.37±0.32	1.04±0.41	1.32±0.19	NS
Cholesterol (mg/ dl)	167.50±13.93	169.50±20.75	178.66±18.80	162.00±14.56	199.33±11.19	NS
AST (RFU/ dl)	40.93±3.12	47.61±5.30	38.80±2.45	37.58±3.74	38.75±2.26	NS
ALT (RFU/ dl)	17.20±2.92	17.03±2.81	21.34±2.29	18.22±2.67	21.08±2.36	NS

A/ G ratio (Albumin/ Globulin ratio) Sig. = Significance, NS = Non Significant.
(T1): basal diet (BD), (T2): BD + Peppermint Oil 250 mg/ Kg; (T3): BD + Thyme Oil 250 mg/ Kg; (T4): BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg and (T5): BD + Rice Hulls 20 g/ Kg.

Table (6): Effect of different dietary treatments on intestinal enzyme activity, (35 days of age)

Items	Dietary Treatments					
Enzyme Activity (Units)	**1**	**2**	**3**	**4**	**5**	**Sig.**
Ilium Amylase	31.39^{d}±3.70	90.53^{c}±0.71	163.29^{a}±4.79	136.03^{b}±2.59	160.46^{a}±0.40	**
Ilium Protease	6.66^{d}±0.82	15.76^{c}±0.19	30.54^{a}±1.07	22.59^{b}±0.57	30.52^{a}±0.47	**

$^{a, b, c, d}$ Means within the same row with different superscripts are significantly different. Sig. = Significance ** ($P \leq 0.01$)
(T1): basal diet (BD), (T2): BD + Peppermint Oil 250 mg/ Kg; (T3): BD + Thyme Oil 250 mg/ Kg; (T4): BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg and (T5): BD + Rice Hulls 20 g/ Kg

Table (7): Effect of different dietary treatments on intestinal bacterial count, (35 days of age)

Items (log CFU/ g)	**Dietary Treatments**				
	1	**2**	**3**	**4**	**5**
	Control	PO 250 mg/ Kg	TO 250 mg/ Kg	BAT 1 g/ Kg	RH 20 g/ Kg
Total Count	6.58	6.78	6.40	6.49	6.90
Coli-form Count	7.41	6.91	6.93	6.98	6.70
Lactic acid Count	4.02	2.93	3.75	5.23	4.03

(T1): basal diet (BD), (T2): BD + Peppermint Oil 250 mg/ Kg; (T3): BD + Thyme Oil 250 mg/ Kg; (T4): BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg and (T5): BD + Rice Hulls 20 g/ Kg.

Table (8): Effect of different dietary treatments on economic traits

Items	Dietary Treatments					
Economic Traits	**1**	**2**	**3**	**4**	**5**	**Sig.**
Average Feed Intake (Kg)	2.79^{a}±0.09	2.70^{ab}±0.01	2.60^{b}±0.06	2.73^{ab}±0.02	2.73^{ab}±0.01	*
Total Cost (LE)	16.51±0.34	16.63±0.01	16.50±0.23	16.36±0.08	16.34±0.02	-
Feed Cost (LE)	10.01±0.34	10.13±0.01	10.00±0.23	9.86±0.08	9.84±0.02	-
Live Body Weight (Kg)	1.85±0.01	1.85±0.03	1.81±0.03	1.80±0.01	1.77±0.02	NS
Total Return (LE)*	24.92±0.07	24.96±0.47	24.51±0.44	24.34±0.15	23.94±0.39	-
Net Return (LE)	8.41±0.26	8.33±0.46	8.00±0.21	7.97±0.06	7.60±0.37	-
Economic Efficiency (EE)	51.08 ±2.66	50.11 ±2.76	48.48 ±0.62	48.72 ±0.13	46.48 ±2.21	NS
Relative Economic Efficiency (EE)	100.00 ±0.00	98.10 ±5.41	94.90 ±1.22	95.37 ±0.26	90.99 ±4.33	NS
Performance Index [1]	119.38^{ab} ±3.36	123.57^{a} ±4.72	123.50^{a} ±1.54	115.87^{ab} ±0.34	112.04^{b} ±3.51	*
Production Efficiency Factor [2]	341.10^{ab} ±9.62	336.29^{ab} ±3.62	352.88^{a} ±4.40	331.05^{ab} ±0.98	320.11^{b} ±10.05	*

$^{a, b, c}$ Means within the same row with different superscripts are significantly different, Sig. =Significance ** (P<0.01) * (P<0.05). NS= Non Significant.

1: North (1981), 2: Emmert (2000), * According to the local price of Kg LBW which was 13.00 L.E.

(T1): basal diet (BD), (T2): BD + Peppermint Oil 250 mg/ Kg; (T3): BD + Thyme Oil 250 mg/ Kg; (T4): BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg and (T5): BD + Rice Hulls 20 g/ Kg.

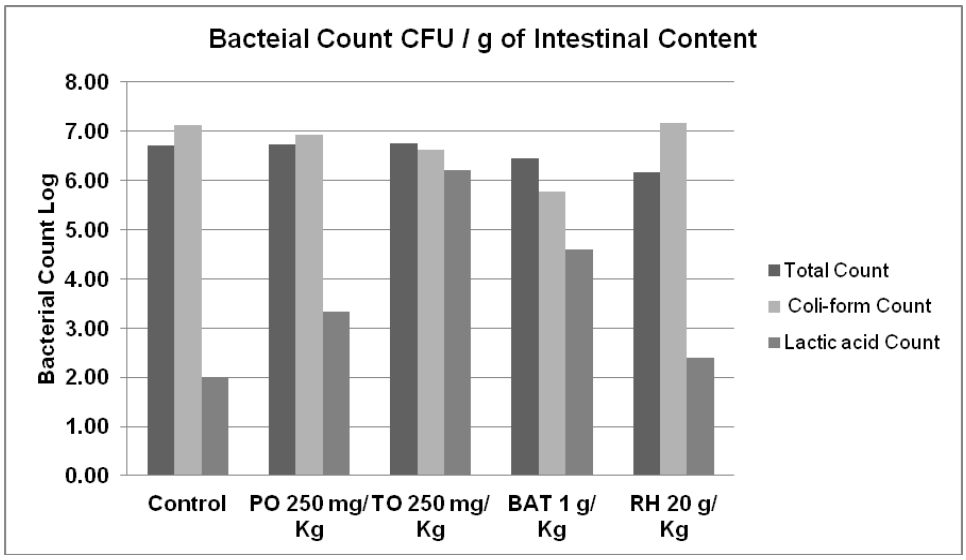
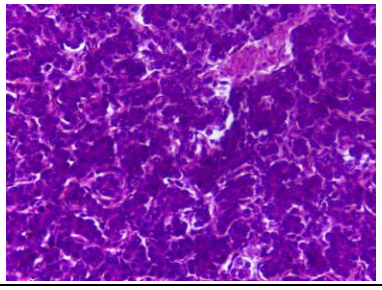
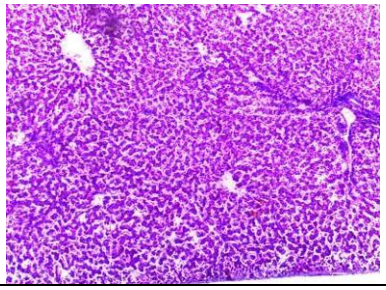


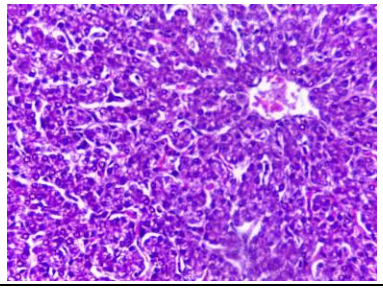
Figure (1): Effect of different dietary treatments on intestinal bacterial count. (35 days of age)



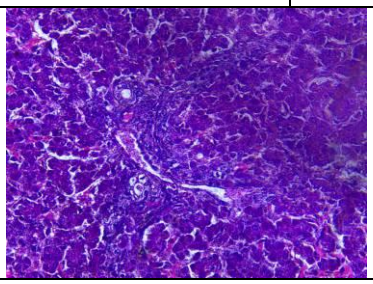
T1: basal diet (BD)



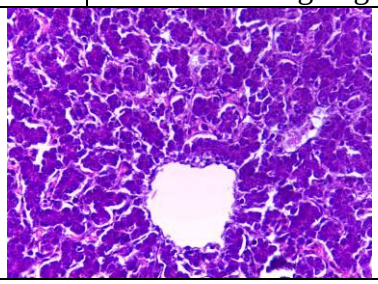
T2: BD + Peppermint Oil 250 mg/ Kg



T3: BD + Thyme Oil 250 mg/ Kg

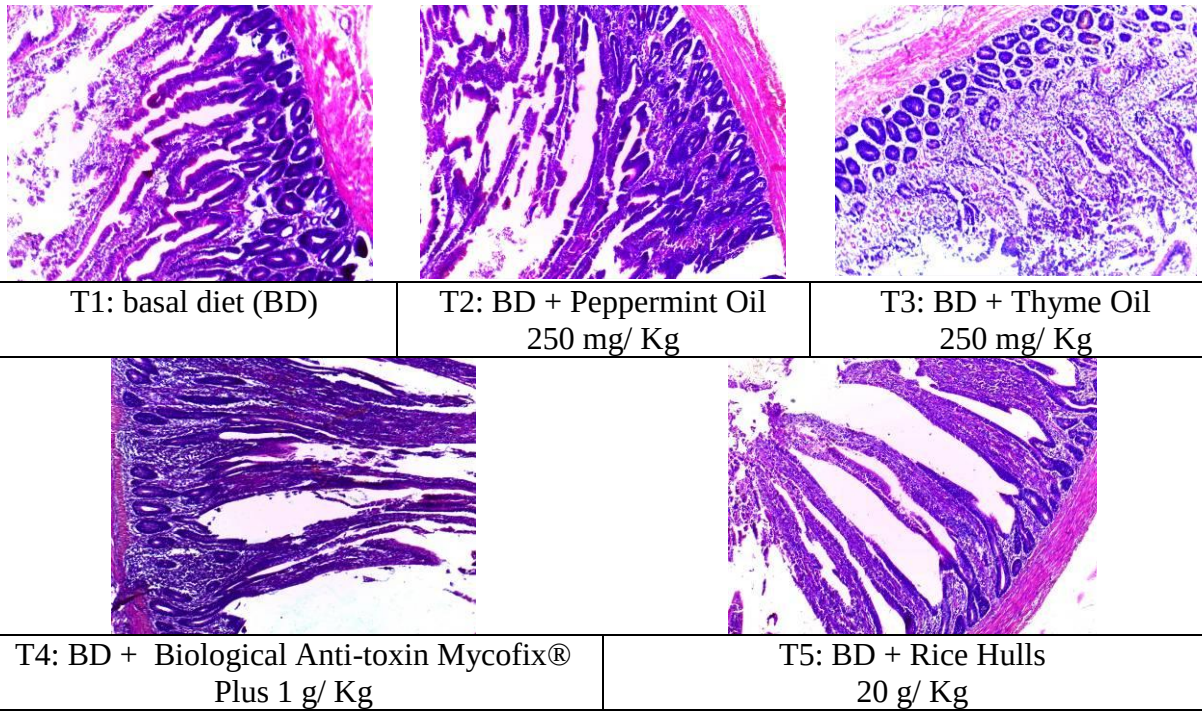


T4: BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg



T5: BD + Rice Hulls 20 g/ Kg

Figure (2): Transverse section, liver of broilers (H&E, 40x). (35 days of age)



T1: basal diet (BD)	T2: BD + Peppermint Oil 250 mg/ Kg	T3: BD + Thyme Oil 250 mg/ Kg

T4: BD + Biological Anti-toxin Mycofix® Plus 1 g/ Kg	T5: BD + Rice Hulls 20 g/ Kg

Figure (3): Transverse section, small intestine of broilers (H&E, 10x).. (35 days of age)

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الملخص العربى

استخدام إضافات غذائية طبيعية كبديل لمضادات السموم الفطرية في علائق دجاج التسمين

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تم إستخدام عدد ١٦٥ كتكوت هبرد غير مجنس عمر يوم واحد لمدة ٥ أسابيع لدراسة تأثير إستخدام بعض الإضافات الغذائية كمضادات سموم فطرية، على الآداء الإنتاجى، مقاييس الدم و بعض الصفات الهستولوجية والكفاءة الإقتصادية لكتاكيت التسمين. تم توزيع خمسة معاملات غذائية كالآتى؛ (T1) غذيت عليقة قاعدية (BD)؛ (T2) PO, غذيت عليقة قاعدية + زيت نعناع ٢٥٠ مجم/ كجم؛ (T3) TO, غذيت عليقة قاعدية + زيت زعتر ٢٥٠ مجم/ كجم؛ BA, (T4) غذيت عليقة قاعدية + مضاد سموم فطرية بيولوجى (Mycofix® Plus) ١ جم/ كجم و (T5) RH, غذيت عليقة قاعدية + سرسة الأرز ٢٠ جم/ كجم. شملت كل معاملة عدد ٣٣ طائر فى ثلاث مكررات بكل منهم ١١ طائر لكل مكرر.

أوضحت النتائج عدم وجود فروق معنوية فيما بين المعاملات التجريبية كلها فى القيمة الإجمالية (٠-٥ أسابيع) لوزن الجسم الحى، ولوزن الجسم المكتسب اليومى. القيم الإجمالية (٠-٥ أسابيع) للعلف المستهلك اليومى أظهرت أن الطيور المغذاة عليقة (T3) إستهلكت غذاء أقل عند مقارنتها بمعاملة المقارنة، فى حين أن الطيور المغذاة علائق (T2)، (T4) أو (T5) كانت متشابهة. بالمثل، فإن القيم الإجمالية (٠-٥ أسابيع) لمعامل التحويل الغذائى أوضحت أن الطيور المغذاة عليقة (T4) أو (T5) أظهرت أسوأ معامل تحويل غذائى عند مقارنتهم بالطيور المغذاة عليقة (T3)، فى حيت كانت متشابهة معنويا مع الطيور المغذاة عليقة قاعدية (T1) أو عليقة (T2). لم تتأثر خصائص الذبيحة، بما فيما الأعضاء المناعية، بالمعاملات التجريبية بإستثناء طول القناة الهضمية و نسبة دهن البطن. بالمثل، فإن المعاملات التجريبية لم تؤثر معنويا فى كل مقاييس بلازما الدم المقدرة. تغذية الطيور علائق (T3) أو (T5) حَسَّنت نشاط إنزيم أميليز و بروتييز فى اللفائفى عند مقارنها بالطيور المغذاة العليقة المقارنة (T1). أيضا، الطيور المغذاة عليقة (T4) أظهرت تأثير إيجابى على تعداد بكتريا حمض اللكتيك بالأمعاء. الكفاءة الإقتصادية إنخفضت بالتغذية على أى من العلائق التجريبية عند مقارنتها بالعليقة المقارنة.

من واقع نتائج هذه الدراسة، يمكن إستنتاج أن إستخدام زيت النعناع أو زيت الزعتر أو مضاد السموم الفطرية البيولوجي أو سرسة الأرز، كان له بعض التأثيرات الإيجابية على الآداء الإنتاجى ولكن بدون تأثير واضح على الكفاءة الإقتصادية. بالإضافة إلى أن إستخدام الإضافات الغذائية الطبيعية كان له تأثير إيجابى على النشاط الإنزيمى و التعداد البكتيري فى الأمعاء دون أى تأثير ضار على صحة الطائر ويقترح إجراء المزيد من الدراسات لتوضيح آثار إستخدام هذه الإضافات