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EFFECTS OF USING AROMATIC HERBAL EXTRACT AND BLENDED WITH ORGANIC ACIDS ON PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE OF POULTRY

2 – THE GROWTH DURING COLD WINTER STRESS

By

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Abstract: *A total of 200, three-week-old Bandarah (Egyptian strain) cockerels, were assigned into five equal groups, 40 birds each, with two replicates in floor pens. The 1st group was fed a basal diet and used as a control, while the 2nd and 3th groups were fed basal diet supplemented 1 or 2 g/ kg feed of RepaXo (mixture of volatile oils), respectively. Also, the 4th and 5th groups were fed basal diet supplemented with 1 or 2 g / kg feed of Avigro (mixture of volatile oils along with organic acids), respectively. All groups were reared under cold temperature daylight 17 ℃ and night 10 ℃ during winter months and housed in floor pens till the end of the experiment that lasted up to at 12 wks of age.*

Results showed that: productive performance of Egyptian meat production birds (body weight gain, mortality rate, feed consumption and feed conversion) and carcass quality (dressing %, breast% and giblets%) were improved (P<0.05) with the addition of aromatic herbal extract alone or its blend with organic acids to the diets under cold environmental conditions. Physiological improvements (P<0.05) in plasma Tri-iodothyronine (T_3), plasma total protein as well as albumin and globulin, and blood indices (Hemoglobin and Hematocrit) were observed. However, plasma total cholesterol and plasma total lipids were reduced (P<0.05). Nevertheless, creatinine, AST and ALT were not affected by different levels of both additives. Revealing to the immunological performance, HI titter of Newcastle disease virus was significantly (P<0.05) higher with addition of both additives at all levels. Besides, the relative weight of lymphoid organs (liver) and glands (thymus, thyroid and bursa of fabricus) were increased significantly due to feeding diet included both supplements. Furthermore, experimental treatments improved (P<0.05) erythrocytic cells and leukocytes in terms of heterophil, lymphocytes and eosinophil, despise of

reducing (P<0.05) Monocyte cells as compared with the control ones. Moreover, the counts of harmful microorganisms such as E. coli were (P<0.05) decreased and Clostridium perfringenes were disappeared corresponding to experimental additives at both levels. This study suggested that aromatic herbal extract alone or its blend with organic acids could be advisable to use in diets of meat chicks to improve the productive, physiological performance and immune response under cold environmental temperature.

INTRODUCTION

Low ambient temperatures cause an increase in feed intake, but also results in reduce growth, nutrient digestibility and feed conversion in poultry (Ensminger *et al.*, 1990 and Spinu and Degen, 1993). Cold conditions cause decreases in plasma concentrations of some vitamins, minerals and insulin in poultry (Ensminger *et al.*, 1990 and Siegel, 1995). Immune status may be depressed when chicks are exposed to suboptimum ambient temperatures (Henken et al., 1983). Nowadays, aromatic plants and their oil extracts are becoming more important in poultry production as growth promotants. Scientific research has a tendency to use non-traditional feed additives which has a positive effect on the human health substituting for any synthetic drugs in animal feeds to avoid its hurtful effect. Therefore, the researches for alternative feed supplements have been increased extensively and considerable attention has been given to the herbs essential oils as growth promotants (Deschepper et al., 2003). Aromatic Herbal Extracts have some properties as growth enhancers to improve physiological and productive performance of meat production birds under stress conditions. It has a stimulating effect on animal digestive system (Langhout, 2000). Williams and Losa (2001) postulated that the effects of essential oils could be due to the increased production of digestive enzymes and the improved utilization of digestive products through enhanced liver functions. Also, it has been studied for their antimicrobial abilities according to Marino *et al.* (1999) who reported that all essential oils had significant bacteriostatic activity against the microorganisms (gram-positive and negative bacteria) and the oil from thyme in full flower was the most effective in stopping the growth of the microbial species. Jamroz et al. (2003) and Mitsch et al. (2004) determined that plant extract (carvacrol, cinnamaldehyde and capsaicin) reduced the total *E. coli* and can control Clostridium perfringens colonization in the intestine and feces of broiler chickens. Herbal growth promoter (essential oil) had significant improvement of body weight, weight gain, mortality rate and feed conversion in broilers (Abdel-Malak *et al.* 1995, and Ibrahim *et al.* 1998) in

ducks (Ghazalah and Ibrahim 1996) and in Japanese quail (Abd El-Latif *et al.* 2002).

Organic acids could be added to the feed or drinking water of poultry flocks to improve production or to reduce the spread of disease. Organic acids have antimicrobial, disinfecting and hygienic uses in animal feed industry (Griggs and Jacob 2005). Hinton and Linton (1998) postulated that organic acids may stimulate endogenous enzymes and regulate gut microbial flora and help in maintaining animal's health. Organic acids (Formic, acetic and propionic acids) have the enhancement of the intestinal absorption of calcium **(Kishi et al., 1999),** calcium and phosphorus **(Boling et al., 2001)** and potential to reduce *Salmonella* and *Campylobacter* colonization in the gut of poultry **(Griggs and Jacob 2005).** The key basic principle on the mode of action of organic acids on bacteria is that nondissociated (non-ionized, more lipophilic) organic acids can penetrate the bacteria cell wall and disrupt the normal physiology of certain types of bacteria **(Dhawale, 2005).**

This work was performed to understand the effects of non-traditional feed additives (Aromatic Herbal Extract alone or its blend with organic acids) on productive, physiological and immunological performance of Egyptian meat production birds (roosters) during cold environmental temperature (winter season).

MATERIALS AND METHODS

The present experiment was carried out at Sids Poultry Breeding Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Beni-Suef Governorate, Egypt, during winter season (December, January and February) under cold climatic temperature 10°C - 17°C and 30-40% relative humidity.

Birds, diets and experimental design:

two hundred, three weeks old cockerels of Bandarah (Egyptian strain) were randomly assigned to equal five groups of 40 chicks each in two replicates kept under similar conditions of floor pens. The first group was fed on a commercial diet (Table,1) and saved as control group, while the 2nd and 3rd groups were fed on the same diet enriched with Repaxol (mixture of volatile oils including thyme, oregano, cinnamon and capsicum) at 1 or 2 g /kg feed, respectively. Also, the 4st and 5st groups were fed on the control diet inoculated with 1 or 2 g Avigro (mixture of volatile oils along with organic acids (malic, citric, and fumaric) /kg feed, respectively. The nutrient compositions of the basal diet were formulated according to the

decree No 1498 (1996) issued by Ministry of Agriculture. The experimental basal layer diet was analyzed following procedures detailed by the A.O.A.C (1990) for CP, CF, DM and EE; however, NFE was calculated by difference and ME was calculated. considering the ME values of different feed ingredients.

Management and measurements:

The birds were submitted to the same conditions of management of broiler farms, given feed and water *ad libitum*, and 24 hours light throughout the experimental period which lasted at 12 wks of age, from December 2008 to February 2009. A vaccination schedule was used for Newcastle disease virus (NDV) during the rearing period. Lasota vaccine against (NDV) was used to immunizing the flock before slaughtering process by about 15 days. Individual body weights were recorded at the beginning then at interval periods of 2-weeks. Feed consumption was measured weekly and feed conversion was calculated. Mortality was recorded daily throughout the experimental period. At the end of the experiment (12 wks of age), two birds per replicate were randomly chosen, sacrificed and slaughtered to determine the dressing, the breast and the giblets percentages. Lymphoid organs (spleen, thymus, Bursa of Fabricius gland and liver) and thyroid were also weighed and presented as relative body weight (mg/100g body weight).

Blood Parameters:

Two blood samples were collected during slaughtering in heparinized tubes per bird. Erythrocytes, leucocytes and the differential counts of leucocytes were determined in the first sample. While, the second one was used to determine the hemoglobin (g/dl) by hemoglobinometer and hematocrit (%) by centrifuged heparinized microhematocrite tubes, then plasma separated and stored in deep freezer at -20°C until analyzed. Tri-iodothyronine (T_3) (ng/dl), total protein (g/dl), albumin (g/dl), alanine transaminase (ALT) (U/L), aspartate transaminase (AST) (U/L), total cholesterol (mg/dl) and total lipids (mg/dl) concentrations were colorimeterically determined. The manufacture recommendations of commercial kits were used for all determinations. Hemagglutination-inhibittion (HI) test was applied for determination of antibody response according to Laver (1969).

Bacteria Enumeration:

At the time of slaughter test, 4 samples of ileum and colon rectum contents for each treatment were taken in order to enumerate total *E. Coli*, ($x10^6$ CFU / cm fluid) *and Clostridium perfringenes* (x10 CFU / cm fluid) numbers. Pathogenic bacteria were counted and defined as the procedure of A.O.A.C. (1990).

Statistical analyses:

Data were subjected to statistical analysis using computerized analysis of variance and Duncan's multiple range test procedures within (SAS software, 1998). The percentage values were transferred to percentage angle using arcsine equation before subjected to statistical analysis, and then actual means are presented.

RESULTS AND DISCUSSION

1- Body weight gain and mortality rate:

Chicks fed on aromatic herbal extract either alone or blended with organic acids under cold winter stress condition increased ($P<0.05$) body weight gain while, the mortality rate was ($P<0.05$) decreased when compared with those fed on un-supplemented control diets at 8 or 12 weeks of age (Table 2). Similar results were obtained by Abd El Malak, et al. (1995) and Ibrahim et al. (1998) in broiler and Abd El Latif et al. (2002) in Japanese quail. This result agreed with that of Hertrampf (2001) who stated that essential oils derived from spices and herbs could be successfully used as growth promoters. They increased feed intake due to their aromatic characteristics in chickens, increased production of digestive enzymes and the improved utilization of digestive products through enhanced liver functions (Langhout 2000 and Williams and Losa 2001). Also, Bassett, (2000); Langhout (2000) and Kamel (2001) observed positive effects of essential oils on growth performance in chickens in terms of weight gain, feed consumption and viability and feed : gain ratio compared to the control. They indicated that the effects become more pronounced when chickens were subjected to stressful conditions such as less digestible diet and/or a less clean environment. Such improvement may be attributed to the properties could act not only as antibacterial, antiprotozoal and antifungal but also as antioxidants. Also, the positive effects of these additive may be attributed to the biological function or pharmacological activities of these extract components (carvacrol, cinnamaldehyde and capsaicin).

Also, the superiority of birds fed on the aromatic herbal extract blend with organic acids may be due to the acidic conditions (Dofing and Gottschal 1997). The acidic pH makes the nutrients more available which monitors better performance and allows the establishment of microorganisms (Boling et al., 2001). Moreover, Organic acids may stimulate endogenous enzymes and regulate gut microbial flora (Hinton and Linton 1998). Conkova and Para (1997), Garcia et al. (2000) and Boling et al. (2001) detected that addition of broiler diets with organic acids increased ($P<0.05$) body weight gain and viability.

2- Feed consumption and conversion:

Feed consumption was ($P<0.05$) increased and feed conversion was ($P<0.05$) improved with the addition of different levels of aromatic herbal extract and its blend with organic acids when reared under cold temperature conditions (10-17°C) compared to those fed on un-supplemented control diets at 8 or 12 weeks of age (Table 2). Increasing feed consumption may be attributed to flavoring effects which improve the palatability of feed due to the components of the oil blend (oregano, cinnamon, thyme and capsicum). These results are in accordance with those of Bassett, (2000): Langhout (2000); Kamel (2001); Williams and Losa (2001) and Hertrampf (2001): Hernandez et al. (2004) who found that feed intake was increased with addition of essential oils derived from spices and herbs whereas, feed : gain ratio was lower compared to the control when chickens are subjected to suboptimal conditions. Hernandez et al. (2004) showed that a blend of the essential oils of cinnamon, capsicum, and oregano improved some aspects of digestibility in broilers. Also, Ghazalah and Ibrahim (1996) stated that thyme oil gave the best of feed utilization efficiency. Also, the inclusion of extract (cinnamon, capsicum, and oregano) at 100 g/t (Laurence et al. 2005), thyme oil (Bolukbaşi and Erhan 2007) or 1.0% thyme or oregano (Radwan et al., 2008) to laying hens diets improved feed conversion ratio.

The improvement in feed conversion obtained from chicks fed aromatic herbal extract blended with organic acids may be due to the acidic conditions. The acidic pH makes the nutrients more available (Boling et al. 2001) which monitors better performance and allows the establishment of microorganisms, particularly Lactobacillus spp (Sarra et al. 1985) and prevents E. coli growth and these conditions make the absorptive area more beneficial (Dofing and Gottschal 1997). Organic acids has several beneficial effects such as improving appetite and improved feed conversion (Fushimi et al. 2001): stimulate endogenous enzymes (Hinton and Linton 1998) and

increase calcium retention and nutrients absorption (El-Afifi and El-Alaily 2001).

3 – Carcass traits:

In comparison to control diet, significance increases ($P<0.05$) in dressing, breast, giblets and edible relative weights were detected due to the addition of aromatic herbal extract separately or blended with organic acids (Table 2). Previous findings of Abdel-Malak et al (1995), Ibrahim et al. (1998). Langhout (2000), Lee et al. (2004) and Hernandez et al. (2004) showed that dressing % of broiler was significantly ($P<0.01$) higher by supplemented different levels of herbal feed additive or herbal plant extracts.

4- Blood constituents

Aromatic Herbal Extract alone or blended with organic acids to diets increased ($P<0.05$) total protein as well as albumin and globulin and plasma T_3 comparing to un-supplemented control group under cold environmental temperature as shown in (Table 3). Ratio of A/G was decreased ($P<0.05$) with the addition of experimental additives which may be due to the increasing globulin as a result of treatments. These results are in harmony with Abdel Malak et al. (1995), Ibrahim et al. (1998) and Abd El-Latif et al. (2002) stated that adding thyme to Japanese quail diets enhanced ($P<0.05$) T_3, plasma total protein as well as albumin and globulin at 6 wks of age. Increase globulin may be due to the immunostimulant effect of thyme and increasing T_3 due to an increase in peripheral conversion of T_4 to T_3.

Adding the aromatic herbal extract and organic acids to broiler diets did not alter the AST, ALT and creatinine when compared to unsupplemented control groups (Table 3). There were no changes of enzyme activity and the relative weights of liver or creatinine concentration which exhibit healthy, nonpathologecal and non-toxic effect of thyme on liver or kidney. Similar results were obtained by Abdel-Malak et al. (1995) when they added biotonic as herbal feed additive.

Plasma total cholesterol and total lipids were decreased ($P<0.05$) in groups fed aromatic herbal extract either alone or blended with organic acids compered with control groups under cold temperature conditions (Table 3). The results are consistence with what was reported in ducks by Ghazalah and Ibrahim (1996) when stated that ducks given thyme oil had lower values of blood total lipids and total cholesterol content than the control. The decrease of total lipid and cholesterol may be attributed to the lowering effect of thymol and carvacrol on hepatic 3-hydroxy-3-methylglutaryl coenzyme A (HMG-COA) that is needed for cholesterol

synthesis in liver. The pure components of essential oils inhibit HMG-COA reductive activity (Crowell, 1999) which is a key regulatory enzyme in cholesterol synthesis and consequently the hypocholeterolemic effect (Lee et al., 2004). Also, Saito et al. (1999) suggested that a single high dose of capsaicin may inhibit the absorption of lipids from the gastrointestinal tract.

5- Blood indices:

Data in Table (3) showed that addition of aromatic herbal extract and blended with organic acids for 12 wks to chicks diet significantly ($P<0.05$) increased hemoglobin and hematocrit when compared with that of counterpart control diet. The present results are in agreement with those of Radwan (2003) who attributed that to the high level of iron in thyme leaves (743 ppm) which may affect the transport of oxygen needed for hemoglobin synthesis in blood. This improvement may be due to the antioxidant activity of essential oil components, capsaicin (Chevallier, 1996), thyme oil (Hertrampf, 2001) and Cinnamon oil (Friedman et al. 2004). Also, Ibrahim et al. (2000) reported that red blood cells count, hemoglobin and the packed cell volume for rabbits fed diets with 0.5% thyme were significant increased.

6-Immune status:

Feeding diet inclusive Herbal Extract or its blend with organic acids improved ($P<0.05$) the immune status as reflected by HI titter of Newcastle disease or relative weights of immune glands (thymus, and bursa of Fabricius) and thyroid gland compared to their respective control group ones (Table, 4). However, liver relative weight was decreased ($P<0.05$), in despite of no changing in spleen relative weight. The physiological improvement monitored previously may play an important role in immune response. Also, the effective components of thyme and oregano essential oils such as phenolic compounds, thymol and carvacrol may stimulate the immune response as well as the growth and metabolic changes (Dorman and Deans 2000 and Bozin et al., 2006), and thus, capsaicin (Chevallier, 1996) and Cinnamon oil (Friedman et al 2004).

7- Blood hematological picture:

Data in Table (4) shows that dietary Herbal Extract or its blend with organic acids supplementation under the cold stress condition, resulted in significantly ($P<0.05$) increased erythrocytes (RBC's) and Leukocytes (WBC's) counts of blood. Also, the WBC's differential counts such as Heterophil, Lymphocytes and Eosinophil, were increased significantly ($P<0.05$) due to feeding dietary treatments compared to the corresponding

control diet. However, Monocyte cells were decreased ($P<0.05$), in despite of no changing in Basophil cells. These results indicated that experimental additives have an enhancement effect to the humoral immune response which agreed with what reported by Jones et al. (1988); Gross and Siegel (1993); Maxwell and Robertson (1998) and Elston et al. (2000)

8- Bacteria Enumeration:

Addition of aromatic herbal extract or its blend with organic acids had suppressed the counts of pathogenic intestinal bacteria where, severe decreases in counts of E. coli of ileum and caecum. The inhibitory effect is increased with increasing levels of both additions. Moreover, the highest reduction was observed with herbal extract blends with organic acids followed by the separately herbal extract either with 1 or 2 levels. Also. clostridium perfringenes cells were detected in ileum and caecum of the control birds, while Clostridium perfringenes were completely disappeared in all experiment treatments (Table, 5). North (1981) stated that E. coli and Cl. perfringenes are known to be harmful especially when their numbers increase in animal intestine. However, Jamroz et al. (2003) and Mitsch et al. (2004) determined that plant extract (carvacrol, cinnamaldehyde and capsaicin) reduced the total E. coli and can control Clostridium perfringens colonization in the intestine and feces of broiler chickens. Aantibacterial, anticoccidial, antifungal and antioxidant effects of capsaicin (Chevallier 1996), thyme oil (Hertrampf, 2001), and Cinnamon oil (Friedman et al. 2004) were reported. Deighton et al. (1993) stated that thyme oil has phenolic components which are primarily responsible for its antioxidative activity. Marino et al. (1999) reported that all thyme essential oil had a significant bacteriostatic activity against the microorganisms (gram-positive and negative bacteria) and the oil from thyme in full flower was the most effective in stopping the growth of the microbial species. Bolukbaşi and Erhan (2007) found that feeding diet containing 0.1 and 0.5 % thyme oil significantly reduced E. coli concentrations in the feces. These effects may be attributed to what reported by Zekovic (2000) thyme content of pharmacologically active phenolic compounds, thymol and carvacrol which are shown to posses' antimicrobial agents or by Remmal et al. (1993) as biological function of these components. Organic acids have potential to reduce Salmonella and Campylobacter colonization in the gut of poultry (Griggs and Jacob 2005).

In conclusion, taking the obtained results in consideration feeding rooster chicks with diet containing 1 or 2 g/kg Aromatic Herbal Extract with or without organic acids significantly improved performance parameters.

Also, it causes sharp decrease in E. coli and *Clostridium perfringens* bacteria concentrations in the digestive tract, thus, total cholesterol and total lipids in plasma with no harmful side effect on the birds. Such experimental additives at both levels could be used to promote growth of Egyptian roosters particularly Bandarah strain.

Table (1): Composition and calculated analysis of the basal diet fed tothe experimental birds.

Ingredients	Starter % (3 to 9 wks)	Finisher % (10 to 12 wks)
Yellow corn	62.21	71.44
Soybean meal 44 %	24.52	20.00
Wheat bran	9.50	4.69
Limestone	1.60	1.60
Di-calcium phosphate	1.52	1.62
Salt (NaCl)	0.35	0.35
Vit. & Min. Mixture *	0.30	0.30
Total	100.00	100.00
Calculated analysis		
Metabolizable energy (Kcal / Kg)	2754.00	2900.00
Crude protein %	17.00	15.00
Crude fiber %	4.26	3.62
Crude fat %	3.11	3.20
Calcium %	1.05	1.06
Available phosphate %	0.44	0.43
Lysine %	0.93	0.79
Methionine %	0.31	0.28
Met + cystine %	0.60	0.55

* Supplied per Kg of diet: Vit. A. 10 000 IU; Vit. D_3. 2 000 IU; Vit. E.10 mg; Vit. K_3.1 mg; Vit. B_1. 1mg; Vit. B_2. 5 mg; Vit. B_6. 1.5 mg; Vit. B_{12}. 10 mcg; Niacin. 30mg; Pantothenic acid. 10mg; Folic acid.1mg; Biotin. 50mcg;Choline.260mg; Copper. 4 mg; Iron. 30mg; Manganese. 60mg; Zinc.50mg; Iodine.1.3mg; Selenium. 0.1mg; Cobalt. 0.1mg;

Table (2): Effect of experimental treatments on productive performance of Bandarah chicks under cold climate conditions (LSM±S.E).

Treatment	Control	Treatments			
		Aromatic Herbal Extract		Blend with Organic Acid	
Age (wk)		1 gm/kg	2 gm/kg	1 gm/kg	2 gm/kg
	Body weight gain (g)				
8	558.18 ^{d} ±19.20	624.63 ^{c} ±12.11	658.33 ^{b} ±13.03	617.28 ^{c} ±16.14	677.29 ^{a} ±12.88
12	935.38 ^{e} ±24.34	1115.43 ^{d} ±18.22	1243.08 ^{b} ±22.04	1193.36 ^{c} ±28.04	1281.41 ^{a} ±19.50
Mortality rate %					
Absolute	7/40	4/40	3/40	3/40	3/40
%	17.50 ^{a}	10.00 ^{b}	7.50 ^{c}	7.5 ^{0} ^{c}	7.50 ^{c}
Feed consumption (g)					
8	2378.00 ^{e} ±25.90	2554.74 ^{c} ±28.15	2640.00 ^{b} ±15.10	2493.80 ^{d} ±22.20	2695.60 ^{a} ±29.18
12	4340.14 ^{e} ±61.50	4740.60 ^{d} ±40.08	5196.00 ^{b} ±80.20	5024.00 ^{c} ±74.05	5266.60 ^{a} ±62.21
Feed conversion (kg feed /kg gain)					
8	4.26 ^{a} ± 0.08	4.09 ^{b} ±0.06	4.01 ^{cb} ±0.10	4.04 ^{b} ±0.08	3.98 ^{c} ±0.06
12	4.64 ^{a} ± 0.10	4.25 ^{b} ±0.12	4.18 ^{c} ±0.10	4.21 ^{b} ±0.14	4.11 ^{d} ±0.11
Carcass characteristics					
Live body weight (g)	975.5 ±31.62	1115.43 ±25.82	1204.65 ±37.7	1186.73 ±45.23	1294.80 ±75.59
Carcass weight (g)	604.91 ±19.02	755.37 ±15.92	820.13 ±20.33	805.79 ±25.08	883.96 ±26.72
Giblets weight (g)	43.21 ±5.11	56.89 ±6.41	62.76 ±5.13	61.43 ±5.68	66.68 ±6.03
Breast (g)	342.45±4.25	409.36 ±5.34	445.10 ±6.01	437.90 ±5.72	476.66 ±4.46
Dressing (%)	62.01 ^{d}±1.31	67.72 ^{c} ±1.20	68.08 ^{ab} ±1.02	67.90 ^{bc} ±1.17	68.27 ^{a} ±1.23
Breast (%)	35.1 ^{b} ±1.02	36.7 ^{a} ±1.23	36.9 ^{a} ±1.30	36.9 ^{a} ±1.17	36.8 ^{a} ±1.09
Giblets (%)	4.60 ^{c} ±0.53	5.1 ^{b} ±0.39	5.21 ^{a} ±0.34	5.18 ^{ab} ±0.44	5.15 ^{ab} ±0.31
Edible (%)	66.44 ^{b} ±0.46	72.82 ^{a} ±0.91	73.29 ^{a} ±0.53	73.08 ^{a} ±0.24	73.42 ^{a} ±0.34

^{a,b,c} : Row means with no common superscript differ significantly at (P<0.05).

Table (3): Effect of experimental treatments on blood biochemical parameters and blood indices of Bandarah chicks under cold climate conditions (LSM±S.E).

Items	Control	Treatments			
		Aromatic Herbal Extract		Blend with Organic Acid	
		1 gm/kg	2 gm/kg	1 gm/kg	2 gm/kg
Biochemical parameters					
T_3 (ng/dl)	211.49^{d} ±7.24	264.37^{b} ±10.44	273.51^{a} ±8.99	255.43^{c} ±10.07	269.37^{ab} ±12.32
Total protein (g/dl)	4.68^{c} ±0.24	5.21^{b} ±0.19	5.25^{b} ±0.33	5.29^{b} ±0.21	5.38^{a} ±0.25
Albumin (A) (g/dl)	2.81^{c} ±0.19	3.07^{b} ±0.10	3.11^{b} ±0.20	3.10^{b} ±0.14	3.17^{a} ±0.11
Globulin(G) (g/dl)	1. 87^{c} ±0.10	2.14^{b} ±0.09	2.15^{b} ±0.08	2.19^{b} ±0.10	2.21^{a} ±0.12
A/G Ratio	1.50^{a} ±0.03	1.43^{b} ±0.02	1.45^{b} ±0.02	1.42^{b} ±0.02	1.43^{b} ±0.02
UR (mg/dl)	0.33^{a} ±0.01	0.32^{a} ±0.01	0.34^{a} ±0.01	0.33^{a} ±0.02	0.32^{a} ±0.02
Creatinine (mg/dl)	2.11^{a} ±0.03	2.19^{a} ±0.01	2.11^{a} ±0.03	2.16^{a} ±0.02	2.18^{a} ±0.03
AST (U/L)	54.36^{a} ±1.15	53.96^{a} ±1.14	54.14^{a} ±1.18	53.88^{a} ±1.25	54.08^{a} ±1. 21
ALT (U/L)	10.20^{a} ±0.82	9.95^{a} ±0.51	10.05^{a} ±0.72	9.83^{a} ±0.58	9.91^{a} ±0.61
Cholesterol (mg/dl)	110.50^{a} ±2.34	87.70^{b} ±3.15	81.44^{c} ±2.18	82.80^{c} ±2.57	80.28^{c} ±3.01
Total lipids (mg/dl)	6.28^{a} ±1.21	4.82^{b} ±0.76	4.60^{c} ±1.03	4.53^{c} ±1.07	4.37^{d} ±0.88
Blood indices					
Hemoglobin (g/dl)	13.70^{c} ±0.51	14.50^{a} ±0.27	14.40^{ab} ±0.35	14.30^{b} ±0.24	14.50^{a} ±0.36
Hematocrit (%)	28.11^{b} ±0.84	30.10^{a} ±0.66	29.92^{a} ±0.49	29.98^{a} ±0.71	30.10^{a} ±0.42

^{a,b,c} : Row means with no common superscript differ significantly (P<0.05)

Table (4): HI titers, relative weights of some organs (mg/100g B.W) and hematological parameters of Bandarah chicks as affected by experimental treatments under cold climate conditions (LSM±S.E).

Items	Control	Treatments			
		Aromatic Herbal Extract		blend with organic acid	
		1 gm/kg	2 gm/kg	1 gm/kg	2 gm/kg
immunological parameters					
HI titter	105.71^{c} ±6.25	148.21^{b} ±8.31	156.61^{a} ±6.98	153.42^{a} ±7.24	156.12^{a} ±7.11
Live body weight (g)	975.5 ±31.62	1115.43 ±25.82	1204.65 ±37.7	1186.73 ±45.23	1294.80 ±75.59
Bursa	251.15^{b} ±31.6	260.89^{a} ±31.6	259.83^{a} ±31.6	260.39^{a} ±31.6	259.50^{a} ±31.6
Spleen	172.22^{a} ±31.6	172.13^{a} ±31.6	171.00^{a} ±31.6	171.90^{a} ±31.6	171.46^{a} ±31.6
Thymus	381.34^{b} ±31.6	392.67^{a} ±31.6	390.15^{a} ±31.6	390.99^{a} ±31.6	391.57^{a} ±31.6
Liver weight	3594.05^{a} ±31.6	3489.24^{b} ±31.6	3490.64^{b} ±31.6	3497.00^{b} ±31.6	3488.57^{b} ±31.6
Thyroid	56.38^{d} ±31.6	58.27^{c} ±31.6	58.94^{b} ±31.6	58.14^{c} ±31.6	59.47^{a} ±31.6
hematological parameters					
Erythrocytes (x10^{6})	2.8^{c} ±0.12	2.92^{b} ±0.09	2.98^{a} ±0.14	2.97^{a} ±0.11	2.98^{a} ±0.17
Leukocytes (x10^{3})	13.6^{c} ±1.06	14.5^{b} ±1.12	14.9^{a} ±1.30	14.3^{b} ±1.10	14.8^{a} ±1. 15
Heterophil	28.1^{b} ±0.23	28.9^{a} ±0.35	29.2^{a} ±0.17	29.2^{a} ±0.33	29.0^{a} ±0.26
Lymphocytes %	52.3^{b} ±0.46	53.4^{a} ±0.58	53.6^{a} ±0.64	53.4^{a} ±0.75	53.6^{a} ±0.61
Eosinophil %	8.1^{c} ±0.11	8.6^{b} ±0.16	8.50^{b} ±0.14	8.6^{a} ±0.18	8.5^{b} ±0.12
Basophil %	7.6^{a} ±0.06	7.5^{a} ±0.05	7.6^{a} ±0.08	7.5^{a} ±0.06	7.6^{a} ±0.02
Monocyte	3.81^{a} ±0.08	1.7^{b} ±0.03	1.6^{b} ±0.01	1.1^{c} ±0.01	1.20^{c} ±0.01

^{a,b,c}: Row means with no common superscript differ significantly at ($P<0.05$).

Table (5): Effect of experimental treatments on concentrations of E. coli and Clostridium perfringenes intestinal pathogenic bacteria of Bandarah chicks under cold climate conditions (LSM ± S.E

Items	Control	Repaxo		Avigro	
		1 gm/kg	2 gm/kg	1 gm/kg	2 gm/kg
Ileum					
E. coli (x 10^6 CFU / g luid)	2.1^{a} ±0.20	1.7^{b}±0.10	1.5^{c}±0.10	1.5^{c}±0.10	1.2^{d}±0.10
Clostridium perfringenes	0.11 x10	0.00	0.00	0.00	0.00
Caecum					
E. coli (x 10^6 CFU / g fluid)	3.2^{a} ±0.20	2.8^{b}±0.10	2.6^{c}±0.10	2.5^{d}±0.10	2.2^{c} ±0.10
Clostridium perfringenes	0.38 x10	0.00	0.00	0.00	0.00

^{a,b,c}: Row means with no common superscript differ significantly at (P<0.05).

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الملخص العربي

تأثير إستخدام مستخلص الأعشاب العطرية ومخلوطها مع الأحماض العضوية علي الأداء الإنتاجي والفسيولوجي والمناعي للدواجن

٢ - النمو أثناء إجهاد برد فصل الشتاء

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أجريت هذه الدراسة لمحاولة فهم تأثير بعض إضافات مستخلص الأعشاب العطرية فقط (الزعتر والزعترالبري والقرفة والفلفل الأحمر) أومخلوطها مع الأحماض العضوية (ماليك وسترك والفيوماريك) لتحسين الأداء الإنتاجي والفسيولوجي والمناعي لديوك سلالة البندرة المحلية لانتاج اللحم تحت ظروف المناخ البارد. وقد تم استخدام ٢٠٠ ديك عمر ٣ أسبوع تم توزيعهم عشوائيا إلى خمسة مجموعات متساوية كلا منها ٤٠ كتكوت في ٢ مكررات (كل منهما ٢٠ كتكوت) وتم تربيتهم تحت ظروف متماثلة مع تغذية المجموعة الاولى على العليقة الأساسية بدون إضافات (كنترول) والثانية والثالثة على هذة العليقة الأساسية مضافا إليها مستحضر الـ Repaxol™ (مستخلص الأعشاب العطرية من الزعتر والزعترالبري والقرفة والفلفل الأحمر) بمعدل ١ ، ٢ جم/كجم عليقة على الترتيب والرابعة والخامسة على نفس العليقة الأساسية مضاف إليها مستحضر الـ Avigro™ (مستخلص الأعشاب العطرية السابقة مخلوط مع الأحماض العضوية (ماليك وسترك والفيوماريك)) بمعدل ١ ، ٢ جم/كجم عليقة على الترتيب. واستمرت التجربة حتي عمر ١٢ اسبوع خلال الفترة من ديسمبر إلي فبراير تحت ظروف المناخ البارد أثناء فصل الشتاء حيث تراوحت درجة الحرارة الجويه من ١٠ - ١٧ درجة مئوية و الرطوبة النسبية ٣٥- ٤٠%. وكانت النتائج كالآتي : -

١- اضافة مستخلص الأعشاب العطرية منفردة أو مخلوطة مع الأحماض العضوية بكلا المستويين أدي الي زيادة معنوية بمستوي ($P<0.05$) لكل من وزن الجسم المكتسب والغذاء المأكول ووزن الذبيحة والصدر والأجزاء المأكولة وكما تحسنت كل من الكفاءة التحولية للغذاء وحيوية الكتاكيت بمستوي ($P<0.05$) وذلك مقارنة بالتغذية على **عليقة الكنترول**.

٢- الإضافات المستخدمة بكلا المستويين أدت الي زيادة معنوية بمستوي ($P<0.05$) لكل من مستوى هرمون تراي أيودوثيرونين (T_3) والبروتين الكلى والألبيومين والجلوبيولين وتركيز الهيموجلوبين والهيماتوكريت معنويا. بينما لم تتأثر معنويا قيم كل من الكرياتنين وALT وAST في بلازما الدم وذلك مقارنة بالتغذية على عليقة الكنترول.

٣- الإضافات المستخدمة بكلا المستويين أدت الي انخفاض معنوي بمستوي ($P<0.05$) لكل من الكولسترول الكلي و الدهون الكلية في بلازما الدم وذلك مقارنة بالتغذية على عليقة الكنترول.

٤- أدت الإضافات المستخدمة بكلا المستويين إلي زيادة الاستجابة المناعية معنويا ($P<0.05$) متمثلا في زيادة كل من مستوي الأجسام المناعية لفيروس النيوكاسل وخلايا الدم الحمراء والبيضاء بنوعيها Heterophil and Lymphocytes وكذلك الوزن النسبي لكل من غدة البرسا والثيموسية وذلك مقارنة بالتغذية على عليقة الكنترول

٥- الإضافات المستخدمة أدت الي إنخفاض معنوي ($P<0.05$) لعدد الخلايا الميكروبية *E. coli* وكذلك الأختفاء الكامل الخلايا الميكروبية *Clostridium perfringes* في امعاء الدجاج (

اللفائفي والصائمي) وكان الإنخفاض أعلي معنويا ($P<0.05$) مع إضافة مستوي ٢ جم من كل من الإضافتين التجريبيتين وذلك مقارنة بالتغذية على عليقة الكنترول أو مستوي ١ جم /ك علف.

ومن وجهة النظر الغذائية والفسيولوجية والمناعية يستخلص من النتائج إمكانية التوصية بإضافة مستحضر Repaxol (مستخلص الأعشاب العطرية من الزعتروالزعترالبري والقرفة والفلفل الأحمر) أو مستحضر Avigro (مستخلص الأعشاب العطرية مخلوط مع الأحماض العضوية وهي الماليك والسترك والفيوماريك) إلي علائق الكتاكيت المحلية المرباه بغرض انتاج اللحم في الأجواء الباردة أثناء فصل الشتاء لتحسين الأداء الإنتاجي(وزن الجسم ومعدل التحويل الغذائي والحيوية) و الأداء الفسيولوجي (الصفات البيوكيميائية للدم و الإنخفاض الكبير في مستوى الكولسترول والدهون الكلية في بلازما الدم) و الأداء المناعي (الاستجابة المناعية في إرتفاع مستوي الأجسام المضادة للأمراض و إنخفاض عدد الخلايا البكتيريا المرضية قي امعاء الدجاج ولذلك تؤكد النتائج علي أن الإضافات المستخدمة قادرة علي إزالة تأثير اجهاد البرد.