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Protective role of Moringa olifera leaves extract and florfenicol against *E coli* infection and study its effect on growth performance, some hematological, immunobiochemical parameters in turkey poults

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Research

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Abstract

Background: Avian colibacellosis induce high morbidity and mortality among diseases affecting turkey, caused by *E. coli*. There is a higher tendency to utilize medicinal herbs to alleviate diseases because of their reduced risk of side effects.

Aims/Purpose: Fifty turkeys were used to study the main effect of Moringa olifera leaves extract (MOLE) on performance, hematological, immunological and biochemical and to seen the effects of it against *E coli* infection.

Methods: Poults were divided into 5 groups (5 poults in each). Gp (1) healthy poults served as control group, Gp (2) received moringa leaves extract. At 30th day of age Poults in 3rd, 4th and 5th groups were infected with *E coli*. Gp (3) non-treated, Gp (4) treated with florfenicol. Gp (5) received *moringa* leaves extract. Poults were weighted at 1st and 36th day old for estimation of body performance. Three blood samples were taken from 5 poults for hematological and immunobiochemical analysis.

Results: *Escherichia coli* was sensitive to MOLE and florfenicol. MOLE induce significant increase in weight gain, erythrogram, WBCs, protein profile, immunoglobulins and increase in heterophil, phagocytic% killing %, beside improved AST, ALT ALP uric acid, creatinine, lipid profile, nitric oxide, lysosome, IL-10, TNF-α, MDA, improved Food Conversion Rate (FCR).

Escherichia coli induce reduction in weight gain, erythrogram, protein profile, immunoglobulin, CAT, SOD, increase in FCR, WBC, heteropshils, Phagocytic %, AST, ALT, ALP, uric acid, creatinine, nitric oxide, lysosome, TNF-α, IL-10, lipid profile. *E. coli* was re-isolated from all infected turkey poults. *Moringa* extract and florfenicol improved hemato-biochemical parameters

Conclusion: It could be concluded that colibacelossis induced many alteration in performance, haematological, and immunobiochemical parameters. *Moringa* extract and florfenicol minimize adverse effect of *E coli*.

Keywords: *Turkey poults; E. coli; Moringa oleifera; florfenicol; body performance; blood parameters.*

Introduction

Turkey is a domestic poultry species for meat production. Turkeys industry is very important in different countries but in large scale .rearing facilities, it exposed to stressful conditions and diseases **Griggs and Jacob (2005).**

Escherichia coli (E coli) is a one of the main bacterial species normally inhabitants lower intestines of birds. Its Gr-ve (Gram-negative) bacteria have of many strains and serotypes **Rosario *et al.* (2004)**. pathogenic *E coli* induce avian colibacillosis, which is a disease induce severe economic losses in poultry industry through reduction in egg production and mortality rate in both broiler chicks and through eggs leading to mortality during first-week of age **Joseph *et al.* (2023)**.

Antibiotics are involved in treatment bacterial infection and as growth promoters but some antibiotics are capable of depressing immune system **Broom (2017)**. The widespread use of antibiotics in poultry products may produce antibiotic resistant bacteria and antibiotics residue.

Florfenicol is a fluoroquinolone is broad spectrum antibacterial drug highly effective against most Gr+ve & Gr-ve bacteria (Gram-negative and Gram-positive bacteria) beside low toxicity **Brander *et al.* (1991) and Luo *et al.* (2024).** Florfenicol is a a synthetic antimicrobial agent and similar to thiamphenicol in both chemical structure and activity against pathogenic bacteria. Both thiamphenicol and florfenicol are contain p-nitro group on aromatic ring is substituted with a sulfonylmethyl group of chloramphenicol . Florfenicol is not associated with the toxic side effects as have been shown for chloramphenicol **Lunestad and Samuelsen (2008)**. It has been introduced into the veterinary medicine in many countries to replace chloramphenicol. So florfenicol used to overcome enteric diseases in food producing animals and its use is not prohibited as chloramphenicol **Kobal (2004)**. Florfenicol is effective against chloramphenicol resistant strains of bacteria **Lobel *et al.* (1994)**.

Medicinal plants contain many phytochemical components (tannins, alkaloids and phenolic) **Hasan and Qari (2010)**. Moringa oleifera is a member of medicinal plants belong to family Moringaceae ،grow in tropical and subtropical country. Phytochemicals found in various parts of Moringa oleifera**) Abou-zaid and Nadir (2014).** It considered one of the magical plants due to its high medicinal properties. Moringa leafes contain protein, vitamins, minerals (calcium potassium, and iron) beside it contain high concentration of essential amino acid **Mishra *et al.* (2012) and Iko *et al.* (2025).** The aqueous extract of Moringa oleifera contained a bioactive compounds namely tannins, flavonoids, saponin, alkaloids and terpens and other compounds **Sreelatha and Padma (2009); El-Gammal *et al.* (2017)**. Moringa oleifera has antibacterial, antiulcer, antifungal, antioxidant and stimulate immunity. Powder of Moringa leaf or its watery extract were used for improving body performance of broilers due to its contain high levels of protein. It has a protective effect on blood and serum parameters of poultry bird (hematology, liver enzymes and serum chemistry) **Raza (2021)**. More over the MOLE has antioxidant effects **Chumark *et al.* (2008).** Moringa oleifera has antibacterial activity against *Bacillus cereus Psedomonus aeruginosa* and *Staph aureus* **Abalaka *et al.* (2012)**. Moringa oleifera extract either watery or ethanolic has good antibacterial activity against *E. coli* **Ahmed *et al.* (2023)**, beside avoiding bacterial resistance of antibiotics.

The aim of the present study was to investigate the effect of florfenicol *and* Moringa oleifera leaves extract on body performance, some haematological, immunological and biochemical effects induced by *E. coli* in turkey poults.

Materials and Methods

1- Ethical approval: This animal protocol was approved by the ARC-IACUC committee by IACUC protocol number: ARC-AHRI-7٨٢٣-

2- Antibiotic sensitivity test for used E coli (In vitro)

Susceptibility of used *E. Coli* to Moringa olifera leaves extract (MOLE) in comparison to some antibiotics was tested by disc diffusion method **Quinn *et al.* (1994)**.

3- Ration formulation, calculated composition of the experimental diet and Physical composition of feedstuffs: Table (1 &2).

4- Drugs

(a) **Floricol® (Florfenicol 10%)** It is a broad spectrum synthetic antibacterial structurally related to D (-). Threo chloramphenicol. It is a product of Pharma Swede Co., Egypt. Each

mL contains 100 mg of florfenicol base.

(b) **Collection and Preparation of watery extract of Moringa oleifera Leafes:** Moringa oleifera Leafes (200g) were collected; air dried and pounded using pestle and mortar to obtain dried leaves powder. Then the MOLE is obtained by homogenization of 40 g of dried leaves powder with 100 mL boiled water and left for 24 hours at room temperature. The extract filtrated then evaporated at 55°C then dried in oven at 60°C for 48 hr. **Njar *et al.* (1993); Shah *et al.* (2015)**.

5- Turkey poults and experimental design

About 50, 1 day old turkey poults proved free from bacterial infection. All poults were kept under good hygienic condition, conditions. Feed and water were provided ad-libitum throughout the experimental period (table 1). Handling and sample collection protocols were reviewed and approved by the ARC-IACUC committee by IACUC protocol number (ARC-AHRI-78-23). Birds were divided into 5 groups (10 birds/ group), GP (1) healthy poults (-ve control), GP (2) healthy poults received 200mg/kg bwt watery extract of Moringa oleifera leaves for 35 days (1^{st} -35^{th} day of age). At 30^{th} day of age poult in 3^{rd}, 4^{th} & 5^{th} groups were given 0.3ml via nasal route of cultural suspension of *E coli* O٧٨ contain $3X10^7$ organism /ml) **Nakamura *et al.* (1992)**. GP (3) infected with *E coli* and not treated (+ ve control) **Ghandour, (2023)**, GP (4) 10 poults infected with *E. coli* at day 30 and treated with 30mg kg bwt florfenicol for 5 successive days (31-35 days old) **Shen *et al.* (2003)**. GP (5) 10 poults received watery extract of Moringa leaves for 35 days (1^{st}– 35^{th} day of age) **Hussein and Jassim (2019)** and infected with *E. coli* at day 30. Five Poults from each group were individually weighed at 1^{st} and 36^{th} day of age for estimation of weight gain and Food Conversion Rate (FCR). Dead poults in all groups were recorded.

Cloacal swabs were collected from poults of all groups one day post supplementation for re-isolation of *E. coli* .Samples were incubated on nutrient broth at 37ºC for 24h., then subcltured into nutrient agar **Woldehiwet *et al.* (1990).** Isolated bacteria were identified **Quinn *et al.* (1994).**

Five Poults from each group were randomly sacrificed at the end of the experiment (36 days old) and 3 blood samples from each of the five poult were collected:

6- Blood samples

1^{st} blood sample was taken on EDTA tubes, for estimation of blood picture **Feldman *et al* (2000)**.

2^{nd} blood sample was taken on heparin tubes for estimation of phagocytic% and killing % **Wilkinson (1977); Lee and Bacon (1983).**

3^{rd} blood samples for serum separation for blood chemistry.

Blood sample were taken without anticoagulant, left for natural coagulation then separate the serum, then centrifuged and serum samples collected in a pandor of for measuring total protein, albumin, AST, ALT, ALP, uric acid and creatinine by automated quantitative analysis for serum clinical chemistry using 71٥ ٠Automatic Blood Chemistry Analyzer (Ciba–Corning Diagnostic Crop) following the instruction of the produced company. Total lipid, cholesterol and triglycerides were estimated calorimetrically.by commercial kits from Stanbio Company, USA, using. computerized spectrophotometer model Milton Roy 1201. Superoxide dismutase **Nishikimi *et al.* (1972)**, catalase **Sinha (1972**), malanodiladhyde **Nielsen *et al.* (1997)**. serum immunoglobulins (IgA, IgG and IgM) were performed using SANDWICH Elisa **Erhard *et al.* (1992),** Interleukin-10 (IL-10), Tumor necrosis factor alpha (TNF-α) in serum were measured by an specific ELISA kits (WKEA MED Supplies) according to manufacturer's instructions using purified IL-2 and TNF-α antibodies respectively.

Statistical analysis was performed for the obtained data by analysis of variance one-way (ANOVA) using the computerized SPSS program version 16, Duncan's Multiple Range **Tambane and Dunlop (2000)**. The level of significance was set at $p<0.05$.

Results

Antibiotic sensitivity test showed *E. coli* sensitive to MOLE with inhibitory zone about 13 mm and florofenicol with inhibitory zone 20mm and its effective than other used antibiotic as doxycycline which give inhibitory zone 19 mm and Amoxycillin, Gentamycin and Specinomycin which give inhibition Zone 15

mm (Table 3).
Healthy poults received MOLE in tested dose for 35 days (Gp. 2) showed significant elevation (at $p<0.05$) in body weight gain, RBCs, Hb, PCV, phagocytic%, index, killing %, albumin, total globulin,α,β, α globulins, IgG, IGA, IgM coupled with non significant change in A/G ratio. Non-significant changes in heterophil, lymphocytes, eosinophils, basophils, monocyts, AST, ALT ALP uric acid, creatinine, total lipid, cholesterol, triglyceride, nitric oxide, lysosome, IL-10 and TNF-α, MDA and improved FCR in comparison to healthy control poults (Table 5,6,7,8).
Poults infected with *E coli* (Gp. 3) showed depression, dropped wings, off food, conjunctivitis, sneezing, diarrhoea with frothy exudates in their eyes, mortality 30% (Table 4), beside significant decrease (at $p<0.05$) in body weight, weight gain, RBCs, Hb, PCV, serum total protein, albumin, with non significant changes in globulins and A/G ratio. coupled with insignificant changes in lymphocytes, eosinophils, basophils, monocytes, catalase and superoxide dismutase associated with significant elevation (at $p<0.05$) in FCR, WBC, heterophils, Phagocytic%, index, killing %, liver enzymes (AST, ALT, and ALP), uric acid, creatinine, nitric oxide, lysosome, TNF-α, IL-10, lipid profile (T. lipid, triglyceride and cholesterol) as well as non significant changes in α, β & γ globulins but significant increase in immunoglobulins (IgG, IgA, IgM) (Table 4, 5, 6, 7, 8). *E. coli* was re-isolated from all infected poults.
Infected poults treated by florfenicol or MOLE (GP. 4 and 5) showed reduction or disappear in clinical signs, mortality rate (table 4) and significant increase (at $p<0.05$) in body weight, weight gain, significant improvement in most of hematological, Immunological and biochemical parameters and decreased in *E. coli* re-isolated from all poults in comparison to infected non treated poults (GP. 3) (Table 5, 6, 7, 8).
Poults of groups 4 and 5 infected and treated with florfenicol or MOLE showed significant decrease in RBCs, Hb, PCV, CAT, and SOD. Significant increase in Phagocytic ،%index, and killing % total lipid, cholesterol, triglyceride, nitric oxide, lysosome, TNF-α, IL-10, MDA compared to normal control group. MOLE treated group (Gp. 5) showed significant improvements in hematological, immunological and biochemical parameters according to normal control group (Table 4, 5, 6, 7, 8).

Discussion
Disc diffusion test for used *E. coli* showed that MOLE induced inhibitory zone about 13 mm which may be due to the antibacterial activity of it. Florfenicol was effective than other antibiotics. Our results are agreed with **Allam *et al.* (2016)** reported that *E. coli* was sensitive to MOLE and induces inhibitory zone 10.5 mm. Florfenicol is very active against *E. coli* and reduced its re-isolation **Elfar and Shaheen (2013).**
The present investigation declared that MOLE in (Gp. 2) improves the body performance. It increased the weight, weight gain and reduced in feed conversion rate due to presence high levels of protein, minerals, vitamins and essential amino acids in the MOLE, in addition to its hepatorenal protective effects and improvements of intestinal villi leading to improve in nutrient absorption **Allam *et al.* (2016)**. MOLE induce improve in body weight gain and FCR in quail **Ahmed and El-Rayes (2019).** Poults of this group revealed significant improvement in blood and serum parameters. This may be due to the high levels of minerals (calcium, potassium, and iron) vitamins, protein and the essential amino acid in MOLE in addition to its antibacterial activity against *E. coli* (inhibitory zone 13 mm) and antioxidant activity. These results previously reported by **Abbas *et al.* (2018)** who mentioned that MOLE induce significant increase in RBCs, Hb, PCV, WBCs, heterophil, eosinophil and basophil and supported by **Salem *et al.* (2020)** who reported that MOLE induce elevation in phagocytic %, index, killing %. Hyperproteinemia, hyperalbumenemia with hyperglobulinemia specially in γ-globulin with the insignificant increase in **α**, β, g globulin, A/G ratio and non-significant changes in liver enzymes, lipids, uric acid and creatinine in poults received MOLE indicate improvement in liver, kidneys and intestinal status of these birds which ensured by the pathological examination. Elevation of protein level of poults received MOLE can be attributed to the increase albumin level due to hepato-

protective effect of MOLE **Igbinaduwa and Ebhotemhem (2016).** These results were run parallel with those obtained by **Abbas *et al.* (2018),** who reported that broilers fed ration contain Moringa olifera leaves showed improved in liver and kidney functions. Increased serum total protein and albumin in broilers received MOLE may be due to presence large amount of amino acids **Ghandour (2023)**. *Moringa* leave induced significant increase in total proteins, albumin and globulin beside decrease in liver enzymes, total lipids, triglycerides and cholesterol **Abu Hafsa *et al.* (2020)**. In addition to that, healthy turkey poults received MOLE induced increase in SOD and CAT level. This may be due to the antioxidant activity of MOLE. This obtained result was similar to those recorded **Abbas *et al.* (2018)** found that serum SOD and CAT level were elevated in broilers fed ration contain Moringa leaves. Quail received Moringa leaves showed elevation in CAT, SOD and decrease in MDA IL-10 and TNF-α **Ahmed and El-Rayes (2019).** Same change was recorded by **Abu Hafsa *et al.* (2020)** who recorded that broilers feed ration contain Moringa leaves increased CAT and SOD.

Signs of colibacellosis observed in poults of Gp. 3 infected with *E. coli* with 30% mortality rate this may be due to the bacterial endotoxins and damage in internal organs caused by *E coli*. These results previously observed by **Mithint *et al.* (2022)** who stated that Colibacillosis in broilers induce depression, ruffled feather, loss of appetite and diarrhea. Broilers infected with E coli show depression, ruffled feather, loss of appetite and diarrhea **Ghandour (2023)**. The malabsorption and malnutrition in *E coli* infected group lead to reduction in body weight gain and elevation in feed conversion rate in comparison to healthy poults. These results confirmed these previously reported by **Abd El-Aziz (2002)**. Colibacelosis in turkey poults induce malabsorption leading to decrease in nutrient absorption and decrease in body weight gain and increase feed conversion rate **Ahmed *et al.* (2013)**. The obtained results agreed with **Elkomy *et al.* (2019)** and **El-Tahawy *et al.* (2022)** who reported that *E. coli* infection induce significant reduction in body weight gain and elevation in feed conversion rate in broilers. In addition to anemia, leukocytosis with heterophilia and significant increase in phagocytosis%, phagocytic index and killing% observed in Gp. 3 infected with *E coli.* The anaemia is a common feature of *E coli* infection in poultry due to impaired intestinal absorption of iron from inflamed intestinal tract and destruction of erythropoeitin-producing cells in the kidneys due to renal dysfunction induced by *E. coli* **Kaneko *et al.* (1997)**. Colibacelosis in broilers induce reduction in erythrocyte, hemoglobin, paked cell volume and increased in leukocyte, Phagocytosis% and Killing%) **Allam *et al.* (2014); Mohammed (2018)**. In addition, **Farag *et al.* (2021)** mentioned that rabbits infected with *E coli* show reduction in RBCS, Hb, PCV and increased in WBCs, Phagocytosis% and Killing% .This may be due to the bacterial infection and the *E. coli* endotoxins. Hepatorenal dysfunction occurred in poults infected with *E. coli* represented by hypoprotienemia, hypoalbuminemia and hypoglobulinemia beside significant increase in liver enzymes, lipids, uric acid and creatinine. This may be due to the bacterial infection and the *E. coli* endotoxins. Our results were reinforced with those recorded by **Saif *et al.* (2003)** who mentioned that with *E. coli* induce elevation in serum AST, ALT, ALP, uric acid and creatinine. Turkey infected with *E. coli* show reduction in protein profile and elevation in liver enzymes, uric acid, creatinine, total lipid, cholesterol, and triglycerides **Ahmed *et al.* (2013)**. In keeping with this line, **Mohammed (2018)** found that serum total protein, albumin and globulin were significantly decreased coupled with increase in serum in a b, g globulin in broilers infected with E. coli. Broilers infected with E coli show insignificant reduction in total protein, albumin and total globulin beside non-significant increase in a, b , g globulin, AST, ALT, ALP, uric acid, total lipid, cholesterol, triglycerides **Ghandour (2023)**. Significant elevation in Nitric oxide, lysosomes, MDA, IL-10 and TNF-α beside significant reduction in CAT and SOD poults infected with *E coli,* which may be due to the bacterial infection and the *E. coli* endotoxins. Broilers infected with *E. coli* showed increase in Nitric oxide and lysosomes **Foley and Farrell (2003)**. Same changes were

reported by **El-Tahawy *et al.* (2022)** who stated that colibacelosis induce significant increase in serum nitric oxide and lysosome. These results were confirmed by results reported by **Fadl *et al.* (2020)** who stated that infected poults with *E. coli* showed significant decrease in serum CAT and SOD beside increase in IL-10 and TNF-α. Colibacelosiss induce significant increase in nitric oxide, lysosomes, IL-10 and TNF-α in rabbits infected with *E coli* **Farag *et al.* (2021)**.

Poults suffering from colibacelosiss treated with MOLE or florfenicol revealed reduction in clinical signs, mortality, re-isolation of *E coli* beside improved hematological, biochemical, immunological and antioxidant. Same results were recorded by **Abiodun *et al.* (2015)** who stated that broilers received Moringa leaves extract challenged with *E. coli* showed improved both liver and kidney function. MOLE has antibacterial effect against *E. coli* and improved body performance and hematological parameters **Smith (2016).** Quail infected with *E coli* and received Moringa leave extract induced improve in clinical signs and biochemical parameters due to its antibacterial effects **Ahmed and El-Rayes (2019)**. improve in both clinical signs and biochemical parameters may be due to presence of kaempferol and rutin, in MOLE which act as antibiotic and antioxidant leading to inhibition of microorganisms **Ahmed *et al.* (2023)**. MOLE contains numerous phytochemicals with antimicrobial properties, including tannins, phenolic compounds, and flavonoids **Sato *et al.* (2004); Cushnie and Lamb (2005)**. Generally, antioxidant activity of MOLE due to presence of phenolic chemicals which acts as metal chelators beside prevent lipid peroxidation **Michalak (2006)**.

Florfenicol induce is a broad spectrum of antibacterial activity due to inhibition of protein synthesis and a potent bactericidal against many pathogens. Florfenicol is more potent than both chloramphenicol and thiamphenicol. Florfenicol active against both G-ve bacilli, g+ve cocci. It was effective against *E coli* infection and prevents hepatorenal toxicity induced by *E. coli* leading to improve both liver and kidney function **Abdalla *et al.* (2005)**. Same results were reported by **Megahed (2007)** mentioned that chickens infected with *E coli* treated with florfenicol show improved liver enzymes and protein profile. Broilers infected with *E coli* treated by florfenicol show improve in serum protein picture liver enzymes, uric acid and creatinine **El-Nemr (2011) and Wanhe *et al.* (2025).** Broilers challenged by *E coli* treated by florfenicol show beneficial impacts in control the *E coli* infection and improve body weight**,** hematological parameters **Elfar and Shaheen (2013)**. Both MOLE and florfenicol have a beneficial effect in treatment of colibacellosis and improve the examined parameters, but the use of MOLE avoid the side effect, high cost and the probable bacterial resistance of antibiotics.

It could be concluded that *E coli* infection induced many alteration in growth performance, hematological, immunological and biochemical parameters. Using of Moringa olifera leaves extract or felorfenicol minimize hematological, immunological and biochemical changes. So, it is good to use MOLE as protective against *E coli* infection in rearing poults.

Disclosure Statements

Conflict of Interest: The authors have no relevant financial or non-financial interests to disclose and report that there are no competing interests to declare.

Informed consent: For this type of study informed consent is not required.

Funding information: No fund

Ethical approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the ARC-IACUC committee by IACUC protocol number: ARC-AHRI-78.23.

Consent for publication: All authors reviewed the final version of the manuscript and approved it for publication.

Authors' contributions

All authors contributed to the study conception and design, material preparation, data collection and analysis and funding. The experimental diet and growth performance were performed by **Ghada M El Khedr.** The hematological and biochemical investigations were performed by **Doaa IA Mostafa, Marwa Sarha, Heba A Ewis[5]and Sara A Abd El**

Wahab. The microbiological investigation by **Shaimaa A Abd El-kader. Dr Mohammed Kassem** sharing in the design of the study, writing and revision of the manuscript and in the approval of the final draft of it. The first draft of the manuscript was written by all authors who commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Table (1). Ration used in experiment and Calculated composition of the experimental diet

Ingredient	kg	Calculated chemical analysis	
GroundYellow corn	49.7kg	Crude protein %	26.841
Soya bean meal	31.4 kg	Ether extract %	3.7159
Fish meal	6.9 kg	Crud fiber, %	3.549
Corn gluten 60%	7.3 kg	Ca %	1.009
Soy bean oil	1.1 kg	vailable Phosphorus %	0.571
Lysine Hcl78%	0.1 kg	Metabolic energy Kcal/Kg	2923.35
DL- methionine 98%	0.2 kg		
Calcium dibasic phosphate	1.4 kg		
Calcium carbonate	1.7 kg		
Premix	0.1kg		
Toxinil	0.1 kg		
Total	100		

Crude protein% and Ether extract % were chemically analyzed according to the method described by **AOAC (1990)**
Calculated according to the feed composition by **(NRC 1994).**

Table (2). Physical composition of feedstuffs used in formulation of the diets (analyzed).

Ingredient	Nutrient (% as fed basis)					
	Crude protein%	**Ether extract %**	**Crude fiber%**	**Ca %**	**Available Ph %**	**Metabolic energy Kcal /Kgm**
Ground Yellow corn	7.9	3.5	2.2	0.05	0.1	3350
Soya bean meal	44	1.2	7.3	0.35	0.27	2230
Fish meal	65	5	1	3.73	2.43	2580
Corn gluten 60%	60	2.4	1.3	0..07	0.14	3720
Soy bean oil	0.0	00	00	0.0	0.0	8800
Calcium dibasic phosphate	00	00	00	21.3	18.5	00
Calcium carbonate	00	00	00	38	00	00
Lysine Hcl78%	118	0.0	0.0	0.0	0.0	4600
DL- methionine	58	0.0	0.0	0.0	0.0	3600

Table (3). Susceptibility of *E. coli* to Moringa leaves extract and some antimicrobial agents.

Drug	Mark	Potency (mg)	Inhibition Zone (mm)	Sensitive
M.O leaves extract	00	00	13	++
Doxycycline	DX	30 mg	19	+++
Florfenicol	FF	30 mg	20	+++
Amoxycillin	AM	25 mg	15	++
Gentamycin	Gm	10 mg	15	++
Specinomycin	Sp	10 mg	15	++

Table (4). Effect of Moringa leaves extract, *E coli* and florfenicol on clinical signs, mortality rate, lesions intensity and reisolation of *E. coli* of infected poults.

Parameters / Groups	Total No	Clinical signs		Mortality rate		*E coli* reisolation from rectal swabs	
		No	%	No	%	No	%
GP 1	10	00	00	00	00	00	00
GP 2	10	00	00	00	00	00	00
GP 3	10	8	80	3	30	10	100
GP 4	10	2	20	1	10	2	20
Gp 5	10	3	30	2	20	4	40

Table (5). Effect of Moringa leaves extract, *E coli* and florfenicol in body performance in various group of poults.

Parameters	GP 1	GP 2	GP 3	GP 4	GP 5
Initial body weight (gm) 1st day of age	49.21± 0.48	47.89± 0.72	48.61± 0.92	48.71± 0.44	49.04± 0.81
final body weight (gm)36th day of age	2621.27± 1.87^{b}	2759.03± 1.91^{a}	2243.41± 1.76^{d}	2449.60±1. 38^{c}	2409.89± 1.91^{c}
weight gain (gm)	2571.79± 1.39^{b}	2711.14±1.72^{a}	2194.80±1. 98^{d}	2400.89±1. 71^{c}	2360.85± 1.86^{c}
Feed consumption	2791.65	2807.86	2585.45	2510.55	2492.55
feed conversion rate	1.09	1.04	1.18	1.05	1.06

Different superscripts (a, b, c and d) within the same row indicate significant differences at $p < 0.05$

Table (6). Effect of Moringa leaves extract, *E coli* and florfenicol in blood picture in various group of poults.

Parameters & Groups	GP 1	GP 2	GP 3	GP 4	GP 5
RBCs(10^6/cu mm)	4.99±0.69^a	5.14±0.72^a	2.58±0.71^c	4.08±0.55^b	4.89±0.94^a
HB g/dl	10.51±0.83^a	11.17±0.72^a	7.89±0.93^c	9.26±0.44^b	10.69±0.93^a
PCV%	31.78±0.96^a	32.25±089^a	27.55±0.79^c	29.22±0.83^b	32.05±0.88^a
Total WBCs (10^3/cu mm)	13.67±0.89^b	13.49±0.98^b	14.92±0.99^a	13.61±0.89^b	14.47±0.95^a
Hetero(10^3/cu mm)	4.33±0.52^b	4.45±0.71^b	5.08±0.28^a	4.56±0.55^b	4.98±0.44^a
lympho(10^3/cu mm)	4.98±0.71	4.87±0.58	4.80±0.70	4.89±0.62	5.23±0.83
eosino(10^3/cu mm)	1.46±0.21	1.38±0.19	1.31±0.12	1.36±0.12	1.52±0.19
baso(10^3/cu mm)	1.18±0.11	1.14±027	1.12±033	1.16±0.55	1.21±0.26
mono(10^3/cu mm)	1.66±0.17	1.65±0.44	1.61±0.61	1.64±0.21	1.70±0.21
Phagocytosis%	40.33±0.98^c	42.08±0.82^b	43.43±0.65^a	42.10±0.49^b	44.10±0.48 ^{a}
Phagocytic index	3.16±0.41^c	4.31±0.42^b	5.09±0.89^a	4.42±0.63^b	6.12±0.48 ^{a}
%Killing	60.32±0.87^c	62.26±0.87^b	63.16±0.55^a	62.34±0.98^b	64.07±0.55^a

Different superscripts (a, b and c) within the same row indicate significant differences at $p < 0.05$

Table (7). Effect of Moringa leaves extract, *E coli* and florfenicol in some biochemical in various group of poults

Parameters & Groups		GP 1	GP 2	GP 3	GP 4	GP 5
T. Protein (gm/dl)		4.98±0.98^b	6.98±0.71^a	3.65±0.47^c	4.58±0.52^b	4.31±0.42^b
Albumin(gm/dl)		2.77±0.32^b	3.89±0.72^a	1.84±0.37^c	2.62±0.64^b	2.37±0.42^b
Globulin (gm/dl)	**α**	0.62±0.09^b	0.96±0.08^a	0.56±0.09^b	0.62±0.08^b	0.61±0.05^b
	β	0.69±0.07^b	0.85±0.09^a	0.60±0.05^b	0.65±0.09^b	0.65±0.06^b
	γ	0.70±0.08^b	1.28±0.05^a	0.65±0.09^b	0.69±0.11^b	0.68±0.08^b
	total	2.21±0.42^b	3.09±0.69^a	1.81±0.23^c	1.96±0.28^b	1.94±0.31^b
AG ratio%		1.25±0.23	1.26±0.23	1.02±0.17	1.33±0.20	1.22±0.21
AST (U/L)		83.23±1.86^b	82.89±1.82^b	87.09±1.18^a	82.12±1.37^b	82.43±1.71^b
ALT (U/L)		33.78±1.92^b	32.57±1.38^b	37.06±1.78^a	34.23±1.66^b	34.13±1.43^b
ALP (U/L)		116.718±1.52^b	115.54±1.86^b	119.21±1.41^a	117.56±1.32^b	117.93±1.55^b
Uric acid(gm/dl)		3.38±0.92^b	3.16±0.59^b	4.98±0.78^a	4.06±0.72^b	4.11±0.83^b
creatinine(gm/dl)		1.07±0.17^b	0.99±0.09^b	2.08±0.55^a	1.11±0.43^b	1.05±0.21^b
total Lipid(mg/dl)		316.43 ± 1.93^b	314.71 ± 1.06^b	321.08 ± 1.54^a	319.21 ± 1.6^a	316.13 ± 1.14^b
Cholesterol(mg/dl)		98.12±1.32^b	97.21±1.61^b	102.21±1.65^a	100.77±1.43^a	99.05±0.70^b
Triglyceride(mg/dl)		113.55±1.38^b	111.12±1.60^b	118.61±1.16^a	116.06±1.27^a	112.89±1.61^b

Different superscripts (a, b and c) within the same row indicate significant differences at $p < 0.05$

Table (8). Effect of Moringa leaves extract, *E coli* and florfenicol on immuonoglobulin, nitric oxide, lysosomes, IL-10, TNF-α, MDA and antioxidant enzymes in various group of poults.

Parameters Groups		GP 1	GP 2	GP 3	GP 4	GP 5
Immunoglobulin (g/l)	lgA	2.17±0.47^{c}	3.61±0.55^{c}	4.87±0.33^{b}	3.76±0.58^{c}	8.43±0.98^{a}
	lgM	3.89±0.32^{c}	4.85±0.73^{c}	6.09±0.48^{b}	4.89±0.41^{c}	11.69±0.71^{a}
	lgG	5.34±0.48^{c}	6.48±0.62^{c}	8.29±0.44^{b}	6.71±0.71^{c}	12.08±0.79^{a}
nitric oxide		67.71±1.55^{b}	65.66±1.27^{b}	69.26±1.41^{a}	69.21±1.58^{a}	71.08±1.32^{a}
Lysosomes		2.33± 0.56^{b}	1.16± 0.83^{b}	5.11± 0.98^{a}	3.32± 0.83^{a}	3.36± 0.69^{a}
Tumor necrosis factor α (TNF-α)		0.96±0.10^{c}	0.86±0.08^{c}	1.42±0.24^{a}	1.02±0.17^{b}	1.01±0.14^{b}
IL-10		0.92±0.12^{b}	0.89±0.07^{b}	1.18±0.14^{a}	0.95±0.11^{b}	0.96±0.21^{b}
MDA mmol/ml		12.26±0.47^{c}	11.36±0.89^{b}	17.16±1.72^{a}	13.23±1.65^{b}	13.15±1.23^{b}
Antioxidant enzymes (U/L)	CAT	13.51±0.83^{b}	18.34±0.79^{a}	12.18±0.73^{c}	12.24±0.55^{c}	15.98±0.69^{b}
	SOD	29.83± 1.79^{b}	33.33± 1.59^{a}	24.52± 1.44^{c}	26.19± 1.55^{c}	32.01± 1.61^{a}

Different superscripts (a, b and c) within the same row indicate significant differences at $p < 0.05$

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