Egypt. Poult. Sci. Vol. (42) (IV): (403-418) (2022) (2210-1222)

Egyptian Poultry Science Journal

http://www.epsj.journals.ekb.eg/

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

EFFECT OF SUPPLEMENTING DRINKING WATER WITH MANGO LEAVES EXTRACT ON GROWTH PERFORMANCE, PLASMA ANTIOXIDANT, AND BIOCHEMICAL INDICES OF BROILER CHICKS

Enas M. A. Toson[1] and Eman E. Yassien[2]

[1]Anim. and Poult. Prod. Dep., Fac. of Agric., Minia Uni.versity, El Minia ,Egypt.

[2]Agric.chem. Dep., Fac. of Agric., Minia Univ., El Minia ,Egypt.

Corresponding author[*] :Enas M. A. Toson[1] Email :enas.toson@mu.edu.eg

Received: 07/10/2022 Accepted: 20 /11/2022

ABSTRACT: The growing demand for natural-based chemicals in broiler nutrition has necessitated the need to develop sustainable and novel natural products to replace the environmentally unfriendly synthetic chemicals. This study aimed to evaluate the chemical composition and antioxidant potentiality activity of aqueous mango leaf extract (AMLE) and to know whether the extract can be used as an additive in drinking water to enhance the immunity of broiler chicks by evaluating growth performance, carcass characteristics and plasma biochemical indicators. A number of 216 unsexed one-day-old Ross 303 broiler chicks were randomly divided into three groups with six replicates of 12 chicks each. Birds in the first group drank water with no addition (control), while those in the second and the third group drank water supplemented with 10 and 20 mL AMLE per liter, respectively. The results showed that the extract had high antioxidant activity. GC-MS analysis revealed ten components in AMLE. The major compounds identified were 3-(Prop-2-enoyloxy) dodecane (27.93%),Hexadecanoic acid, methyl ester (13.68%), 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl (10.41%), Docosanoic acid, methyl ester (9.53%), n-Hexadecanoic acid (7.84%). In addition, the results revealed that birds of the second and third groups showed significantly improved carcass weight, dressing percentage, hematological, biochemical, and antioxidants indicators compared with the control group. These results encourage the use of AMLE to stimulate growth and to strengthen the immune system of broiler chickens.

Keywords: Mango leaf extract, GC-MS, Carcass characteristics, Antioxidants, Broiler chicks

1.INTRODUCTION

Over the past fifty years, the world's poultry production has significantly increased with animal protein demand. A large part of the chicken meat industry globally comprises broilers production. Broiler chicks are one of the significant sources of meat, and this has made broiler farming a profitable venture due to increased consumer demand for broiler meat. In addition, feed additives have been reported to enhance poultry productivity and increased attention as veritable alternatives to antibiotics in poultry nutrition. Continuous efforts are being made to focus on using plant by-products and extracts as new natural feed additives and decreasing the use of antibiotics in poultry diets, which can affect consumer health according to the European Union's global ban on antibiotics (Reda et al., 2020).

Mango (*Mangifera indica L*) is grown in many countries worldwide on a wide scale that produces annually 38 million metric tons (Orwa et al., 2009). Results reported by Kanwal (2010) showed that mango leaves are rich in phenolic compounds containing mangiferin, flavonoids, gallotannins, and benzophenone. Fernandez-Ponce et al. (2015) reported that mango leaves extract has been rich in phenolic compounds, which is potent antioxidant activity. Also, mango leaves extract has antimicrobial, antifungal, analgesic, anti-diarrheal, anti-inflammatory, and hypoglycemic effects in rats (Islam et al., 2010). Zhang et al. 2017 found that incorporating 0.28 % of Mango saponin in chicks diets could improve growth performance and plasma lipid metabolism.

There is a lack of information on the impact of feeding broiler chickens with AMLE on growth and carcass parameters. Therefore, the present study aimed to evaluate the effects of supplementing AMLE to drinking water on the growth performance, carcass characteristics, and some physiological responses of broiler chicks.

2. MATERIAL AND METHODS

2.1 Preparation of AMLE

Fresh mango leaves were collected from some mango farms in Minia Governorate, Egypt. First, fresh leaves of mango were cut into fine pieces after washed by tap water, then dried under air room temperature. The air dried mango leaves were ground to powder with an electric grinder. Finally, Mango leaves were soaked in distilled water at a concentration of 10% (w/v, 100g of mango leaf powder/liter of distilled water) for 24 hours at a temperature of 37°C with continuous stirring, filtered the resulting solution and kept it at 4°C until use.

2.2 *In vitro* Antioxidant Activity

2.2.1Total Phenolic Content and Total Flavonoid Content

Total phenolic content in AMLE were measured according to Singleton and Rossi (1965) and total flavonoid content according to colorimetric assay (Zhishen *et al*, (1999).

2.2.2. DPPH Radical Scavenging Assay

The DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging activity of the extract was measured by using the method of Bracca et al., (2003).

2.2.3 Reducing Power Assay

Reducing power of AMLE was determined by using the method described by Da Rocha et al., (2019). The antioxidant ascorbic acid was used as a benchmark. All tests were repeated three

times. The EC50 values were calculated based on the related regression equation.

2.2.4 Total antioxidant capacity (TAC)

Phospho molybdenum method was used to evaluate TAC for samples extract. This method relies on the reduction of Mo (IV) to Mo (V) and green phosphate/Mo (V) formation, which is measured spectrophotometrically at 695 nm, with using ascorbic acid as standard. Corresponded increasing solution turbidity with high absorbance value revealed high TAC value (Prieto et al., 1999 and Ghareeb et al., 2013).

2.3 GC-MS Analysis

The chemical composition of AMLE was performed using Trace GC-ISQ mass spectrometer (Thermo Scientific, Austin, TX, USA) with a direct capillary column TG–5MS (30 m × 0.25 mm × 0.25μm film thickness) as previously described by Zhang et al. (2017). The column oven temperature was held initially at 50°C and then increased by 5°C/min to 250°C withhold 1 min then increased to 300 at 30°C /min. The injector temperature was kept at 260°C. Helium was used as a carrier gas at a constant flow rate of 1 mL/min. The solvent delay was 4 mins, then a volume of 1μL of diluted samples were injected automatically using an AS3000 Autosampler coupled with GC in the split mode. EI mass spectra was collected at 70 eV ionization voltages over the range of m/z50–650 in full scan mode. The ion source was set and transfer lines at 250°C and 270°C, respectively. The components were identified by comparing their retention times and mass spectra with those of WILEY 09 and NIST 11 mass spectral databases**.**

2.4 Experimental Design and Procedure

This research was conducted in the broiler chickens sector of the Experimental Farm, Faculty of Agriculture, Minia University, following the standard criteria allowed by the Animal and Poultry Production Department, Faculty of Agriculture, Minia University, Egypt. Two Hundred and sixteen one-day-old unsexed Ross chicks were randomly divided into three experimental groups in six replicates each. Each replicate containing 12 chicks which was housed in a wire cage (100 × 50 × 50 cm), supplied by a feeder and a drinker until 42 days of age. The first group drank un-supplemented water as a control group, while the second and the third groups drank water supplemented with 10 or 20 mL AMLE per liter, respectively. All experimental chicks were fed during the starter period (0-3 weeks) and the grower period (3–6 weeks) on basal diets (Table 1). Determined CP contents in starter and grower diets were relatively close to the calculated one. All broiler chicks were reared under similar environmental and hygienic conditions. Birds were kept under the contentious constant light program and temperature 34°C decreased 2°C weekly until 24°C. Clean water and feed were supplied *ad libitum* during the starter and the grower periods.

The weight of chicks for each replicate at 3 and 6 weeks was recorded to calculate the average weight of chicks of the same age. The consumed feeds, weight gain for each replicate during the starter, grower, and whole experimental periods were recorded to determine the feed conversion (Feed consumption/weight gain) during the same periods.

2.5 Carcass Weight

At 6 weeks of age, 12 birds were selected from each experimental group which were taken to estimate carcass measurements after being starved for 12

hours and killed by cervical dislocation. Carcasses were de-feathered, eviscerated, and then weighed to estimate dressing percentage. Gizzard, liver, heart, kidneys, and abdominal fat, were removed, weighted and expressed as percentages of carcass weight.

2.6 Blood Sampling

At six weeks of age, blood samples were collected from the slaughtered birds in heparinized tubes. The samples were used to determine hematological parameters (White blood cells (WBCs), lymphocytes (LYM), Monocytes (MON), Neurocytes (NUE), red blood cells (RBCs), hemoglobin (HGB), mean corpuscular volume (MCV), mean corpuscular HBG (MCH) and platelet counts (PLT)) as described by Schalm [17]. Blood samples were centrifuged at 3000/min for 15 mins, and kept plasma at −20°C until analysis to estimate biochemical parameters. Some parameters which include liver function, lipid profile, and kidney function were estimated through a spectrophotometer. Commercial kits (Biodiagnostic Company, Giza, Egypt) were used to measure liver function, including total protein (TP, g/dL), globulin (GLB, g/dL), albumin (ALB, g/dL), aspartate transaminase (AST; IU/L), alanine transaminase (ALT; IU/L), creatinine (CR, mg/dL), urea (UE, mg/dL) and uric acid (UA, mg/dL). Lipid profile, including total cholesterol (TC; mg/dL), triglyceride (TG; mg/dL), total bilirubin (TB, mg/dL), Alkaline phosphatase (ALP, g/dL) and lactate dehydrogenase (LDH, mg/dL) concentration. Plasma TAC, U/mL), superoxide dismutase (SOD, U/mL) and catalase (CAT, u/mL), nitric oxide (NO, U/mL) and malondialdehyde (MDA, umol/mL) and glutathione (GSH, ng/ml) were determined using commercial kits and a spectrophotometer (Shimadzu, Japan).

2.7 Statistical Analysis

The experimental data was analyzed by using a linear model with the fixed effect of treatment using the GLM procedure of the Statistical Analyses System 2003. Growth performance, carcass characteristics, hematological and biochemical parameters assessed by one-way ANOVA. Duncan's multiple-test was used to compare the means ($p < 0.05$).

3. RESULTS AND DISCUSSION

3.1 Antioxidant Activity

Polyphenols and flavonoids are important components of both human and animal diets. The total phenolic content and flavonoid content of AMLE are shown in Table 2. The results clearly show that mango leaves are an excellent source of polyphenols and flavonoids that contribute significantly to antioxidant activity. These findings were consistent with those reported by Gazwi et al. (2020).

AMLE was tested for its antioxidant properties using three distinct methods (DPPH, TAC, and reducing power). In addition, a variety of methodologies are used to explain the putative antioxidant activity of the extract. These mechanisms include radical scavenging, reduction activity, and metal chelation.

Table (2) shows that AMLE revealed a radical scavenging activity of DPPH with an IC50 value of 95.76 ± 1.9 µg/mL compared to the standard trolox antioxidant complex with an IC50 value of 46.12 ± 0.68 µg/mL. The high antioxidant potential of AMLE may be because of its high amount of flavonoids and phenols.

According to Feriani et al., (2020), the ability to reduce oxidative stress may be a

significant indicator of antioxidant activity in chemicals and plant extracts. Electron donors can decrease oxidized intermediates in the presence of reducing compounds. The reducing power test relies on reducing ferric ferricyanide complex to ferrous in the presence of antioxidants. Compared with the standard antioxidant (Trolox) EC50 value of 84.15± 19.17µg/mL, AMLE had a higher EC50 value of 544.15± 10.28µg/mL.

By using a spectroscopic approach, TAC was quantified. The TAC of AMLE is 521.28 ± 45.21 µM AAE /100g dry extract (Table 2). Several factors, including antioxidant structure and interactions with phenolic compounds, are involved in the antioxidative activity and concentration.

3.2 GC-MS analysis of the extract

The GC-MS analysis revealed ten bioactive compounds from the AMLE (Fig.1 and Tables 3). The bioactive compounds from extract have been identified through their retention time, compound structure, molecular formula, molecular weight, and concentration (%). These compounds are 3-(Prop-2-enoyloxy)dodecane (27.93%),Hexadecanoic acid, methyl ester (13.68%), 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl (10.41%), Docosanoic acid, methyl ester (9.53%), n-Hexadecanoic acid (7.84%), 9-Octadecenoic acid (Z)-, methyl ester (5.50%) 9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)- (3.04%), Oleic Acid (2.93%) and 3-Eicosene, (E)- with 2.92% (Tables 3 and 4).

Hexadecanoic acid, methyl ester, and 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl have potent antioxidant activity. In addition, Docosanoic acid, methyl ester has therapeutic, diagnostic activities. 9-Octadecenoic acid (Z)-, methyl ester, and n-Hexadecanoic acid are biologically active compounds (Table 3).

3.3 Biological activities

3.3.1 Growth performance

Results in Table (5) showed that the effect of addition AMLE in drinking water of broiler chicks was significant ($p < 0.05$) on body weight, body weight gain, and feed conversion ratio during the grower phase (3–6 weeks) and the whole experimental period (0–6 weeks). The present results showed that the addition of 20mL AMLE per liter drinking water significantly increased final body weight and improved body weight gain and feed conversion ratio during the grower (3–6 weeks) and whole growing periods (0–6 weeks) compared with the control group.

This finding was entirely new because, to our knowledge, no study has examined the effect of adding AMLE in drinking water on growth performance in poultry. The improvement in feed conversion ratio may explain that the supplementation of AMLE with 20 mL/liter drinking water optimizes the efficiency of broiler chicks to use the diets better. There is a possibility that these findings are because of the health-promoting qualities of AMLE, which include antibacterial properties, analgesics, antioxidants, antifungal, and anti-inflammatory properties which could be associated with positive reactions to growth performance due to mango leaf extract supplementation (Garcia et al, 2003 and Garrido et al, 2004). Moreover, Zhang *et al* (2017) added that the improved in growth performance due to the enhanced health status attributed to the improving in plasma antioxidant and biochemical parameters in broiler chicks fed diets supplemented with mango leaves extract.

3.2.2 Carcass characteristics

Results presented in Table (6) showed that the effect of using AMLE in drinking water of broiler chicks on carcass traits was significant ($p < 0.05$) only on carcass weight and dressing percentage. In contrast, this effect was not significant ($p < 0.05$) on edible organs (liver, kidneys, gizzard, and heart) and abdominal fat rate. Adding 20 mL of AMLE to one liter drinking water of broiler chicks significantly improved carcass weight and dressing percentage compared with the other groups which in a superior index of whole edible meat. In agreement with these results, Zhang *et al* (2017) demonstrated that edible organs (liver, kidneys, gizzard and heart) and abdominal fat percentage were not significantly affected by dietary mango leaves extract supplementation. Wezyk et al., (2000) reported that herbs used as antibiotic growth promoters improve carcass production and fatness in broiler chickens.

3.3 Hematological blood parameters

The effect of adding AMLE to drinking water on plasma hematological parameters (WBC's, LYM%, MON%, NEU%, MCV, MCH, and PLT) was not significant ($p < 0.05$), while this is supplement were substantial on HGB%, HCT% and RBCs counts (Table, 7). The current study showed that adding AMLE to the drinking water at a concentration of 20mL/liter for broiler chicks led to a significant improvement in the percentage of HGB, HCT%, and RBC compared with the other groups. The HCT % reflects the percentage of blood composed of RBCs and the total number of RBCs that assess the capacity of oxygen (Maheswaran et al, 2008). Improvements in HGB %, HCT % and RBC counts could be due to the thyroid hormones responsible for rising the RBCs count.

3.4 Biochemical plasma parameters

Liver functions of broiler chicks included total protein (TP) , albumin (ALB), globulin (GL), A/G ratio, aspartate transaminase (AST), alanine transaminase (ALT), lactate dehydrogenase (LDH), total bilirubin (TB) and alkaline phosphatase (ALP) as affected by AMLE supplementation in drinking water are presented in Table (8). These results indicated that plasma TP was significantly ($p < 0.05$) increased and plasma AST and ALT were significantly decreased ($p < 0.05$) by addition of AMLE to the drinking water of broiler chicks. In contrast, this addition was insignificant ($p < 0.05$) on plasma albumin, globulin, and A/G ratio, also plasma lactate dehydrogenase, TP and ALP were not significantly ($p < 0.05$) affected.

The plasma TP and ALB contents as reliable markers of liver function jointly with AST; ALT levels are closely correlated with hepatic lipidosis levels in animals (Attia and Al-Harthi, 2015). Therefore, the increase in plasma TP and the decrease in plasma AST and ALT in the birds that drank water supplemented with AMLE showed that AMLE did not negatively impact liver function and had no adverse effect on the growth and health of broiler chicks.

Data presented in Table (8) show that plasma creatinine, urea, and UA contents in plasma of broiler chicks were insignificantly decreased ($p < 0.05$) by supplementing drinking water with AMLE. In addition, these results showed that using AMLE in drinking water did not adversely affect the kidney function of broiler chicks. Also, these findings

showed that AMLE does not have any toxic substances.

Total cholesterol (TC), triglycerides (TG) levels in broiler chicks were affected by supplementation drinking water with AMLE as presented in Table (8). These results showed that addition AMLE to drinking water significantly decreased TC and triglycerides in broiler chicks plasma, Alvarenga et al. (2011) showed that plasma triglycerides and total cholesterol content express the lipid metabolism status in the body, and the excess accumulation of TG and TC contributes to metabolic disorders in broilers. The results were attributed to the fact that AMLE contains mangiferin, which decreases total plasma cholesterol and triglycerides contents in rats (Muruganandan et al., 2005), and flavonoids that contributed to improved lipid metabolism in broiler chicks (Cao et al., 2012). The reduction verified the lower levels of plasma cholesterol observed since HDL and LDL molecules are leaf cholesterol transporters from their synthesis site to the liver tissues of the body, thus reducing availability of plasma cholesterol and triglycerides for tissue metabolism, liver lipogenesis and carcass fat accumulation (Alvarenga et al, 2011).

3.5 *In vivo* antioxidant activity

Data presented in Table (9) show that supplementing drinking water with 20 mL AMLE per liter significantly increased ($p < 0.05$) plasma superoxide dismutase (SOD), malondialdehyde (MDA), and total antioxidant capacity (TAC). In contrast, plasma glutathione (GSH), nitric oxide (NO), and catalase (CAT) of broiler chicks were not significantly ($p < 0.05$) affected. The high plasma content of antioxidants in the groups of broiler chicks supplemented with AMLE may be due to polyphenols and flavonoids in the mango leaf extract.

The antioxidant enzymes of SOD and GSH, which comprise the body's antioxidant system, preserve oxidative stress on the body. At the same time, MDA and GSH concentrations are considered markers for assessing the body's antioxidant systems. Also, TAC is used to determine biological antioxidant status and identify the response of antioxidants to released free radicals under stress conditions. For example, Alborien et al. (2015) showed that feeding chickens reared under chronic thermal stress on diets supplemented with plant extracts with a high level of phenolic compounds increased GSH activity. Likewise, Ahmed (2019) reported that supplemented broiler chicks' diet with plant products with high antioxidant compound content could improve the reaction of oxygen scavenging to conserve fat sources.

4. CONCLUSION:

In conclusion, adding 20 mL per Liter of AMLE to drinking water improves growth, carcass properties, biochemical plasma parameters, and antioxidants capacity of broiler chicks. Thus, AMLE has potential to be a growth promoter.

Ethics approval

The research on animals was carried out accordings to the animal protection guidelines approved by the university authorities**.**

Table (1): The ingredients and calculated chemical analysis of the experimental diets.

Ingredients	**Basal diet**	
	Starter	**Grower**
Yellow corn	57.00	62.25
Soybean meal 44% CP	30.00	24.48
Corn gluten	6.35	5.10
Wheat bran	0.00	0.00
Vegetable oil	0.35	2.70
Dry yeast	2.50	2.00
Salt	0.25	0.30
Monocalcium phosphate	1.36	1.11
Linestone	1.77	1.73
Methoinine	0.12	0.03
Lysine	0.00	0.00
Premix*	0.30	0.30
Total	100.00	100.00
Calculated chemical analysis		
Metabolizable energy (K cal/Kg)	2900	3100
Crude protein (%)	23.00	20.00
Calcium (%)	1.00	0.93
Available phosphorus (%)	0.45	0.38
Methionine (%)	0.90	0.72
Lysine (%)	1.10	0.94
C/P ratio	126.87	155

*Each 1 kg of vitamins and mineral mixture contains:12000.000 IU vitamin A acetate; 2000.000 IU vitamin D3; 10.000 mg vitamin E acetate; 2000 mg vitamin K3; 100 mg vitamin B1; 4000 mg vitamin B2; 1500 mg vitamin B6; 10 mg vitamin B12; 10.000 mg pantothenic acid; 20.000 mg Nicotinic acid; 1000 mg Folic acid; 50 mg Biotin; 500.000 mg choline; 10.000 mg Copper; 1000 mg Iodine; 300.00 mg Iron; 55.000 mg Manganese; 55.000 mg Zinc, and 100 mg Selenium.

Table (2): Antioxidant activity of AMLE

	Aqueous extract of mango
Total flavonoids (mg QE/g extract)	29 ± 1.4
Total phenolic (mg GAE/g extract)	170 ± 11.3
DPPH (IC50µg/mL)	95.76 ± 1.9
Total Antioxidant Capacity (TAC) (µM ascorbic acid equivalent (AAE)/100 g dry extract)	521.28 ± 45.21
Reducing power (EC50µg/mL)	544.15 ± 10.28

Table (3): GC-MS analyses of AMLE

No.	RT	Name of the compound	MF	MW	Compound nature	Compound Activity**	Peak (%)
1	4.09	3-(Prop-2-enoyloxy)dodecane	$C_{15}H_{20}O$	240	Fatty acid ester	No activity reported	27.93
2	4.39	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O_2$	270	saturated fatty acids ester	Antioxidant, Antimicrobial, anti-hypercholesterolemic property, Antiandrogenic 5-Alphareductase inhibitor activity	13.68
3	5.49	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	Fatty acid	Antioxidant, hypocholesterolmic, nematicide, pesticide, lubricant, antiandrogenic, flavor, haemolytic and 5-Alpha reductase inhibitor activities	7.84
4	5.60	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-	$C_{20}H_{34}O_2$	306	Linolenic acid ester	Anti-inflammatory, Cancer preventive, Hepatoprotective	3.04
5	6.01	9-Octadecenoic acid (Z)-, methyl ester	$C_{19}H_{36}O_2$	296	Fatty acid Este	Anti-inflammatory, antiandrogenic, Cancer preventive, dermatitigenic, hypocholesterolemic, 5-alpha reductase inhibitor,anemiagenic and insectifuge activitie	5.50
7	7.73	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl	$C_6H_8O_4$	144	Heterocyclic Compounds	Anti-inflammatory, analgesic, antibacterial, antifungal	10.41
8	9.08	3-Eicosene, (E)-	$C_{20}H_{40}$	280	Alkene	Alkene No activity reported	2.92
9	27.06	Docosanoic acid,methyl ester	$C_{23}H_{46}O_2$	354	fatty acid	Therapeutic, diagnostic activities	9.53
10	6.51	Oleic Acid	$C_{18}H_{34}O_2$	282	fatty acid	Antimicrobial,Hypercholesterolemic Dermatitigenic, Anti-inflammatory and Anti-tumor activity	2.93

Activity Source**: Dr. Duke's Phytochemical and Ethnobotanical Databases, NCBI-Pubmed, ChemSpider (Royal Society of Chemistry), and other available literature.

Table (4): Bioactive chemical compounds identified in AMLE.

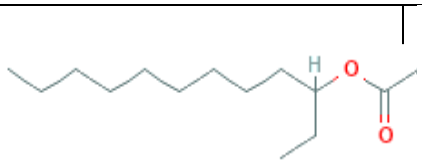
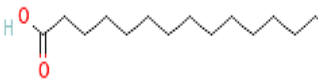
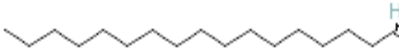
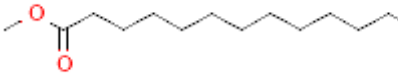
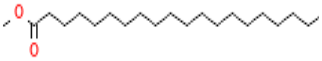
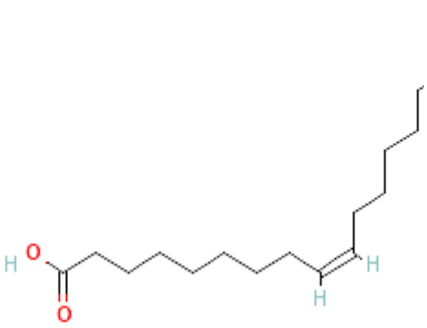
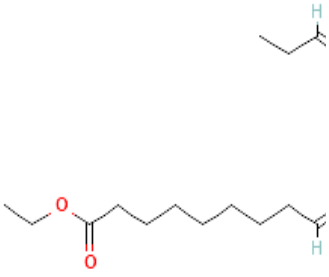
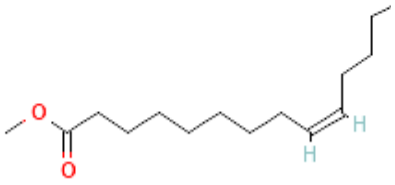
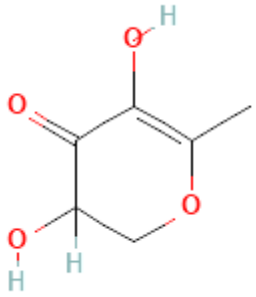
		
3-(Prop-2-enoyloxy)dodecane	n-Hexadecanoic acid	3-Eicosene, (E)-
		
Hexadecanoic acid, methyl ester	Docosanoic acid,methyl ester	3-Eicosene, (E)-
		
Oleic Acid	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-	9-Octadecenoic acid (Z)-, methyl ester
		
4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl		

Table (5): Effect of AMLE supplementation in drinking water on growth performance of broiler chicks

Items	Levels of AMLE in drinking water (ml/liter)			S.E.	Significance
	0	10	20		
Body weight (g) at:					
0 weeks	40.0	39.5	39.7		
3 weeks	648.5	656.1	665.5	2.48	NS
6 weeks	1908.6[b]	1936.7[ab]	2001.6[a]	24.3	*
Body weight gain (g):					
0 – 3 weeks	608.5	616.6	625.8	12..8	NS
3 - 6 weeks	1260.1[b]	1280.6[ab]	1336.1[a]	31.2	*
0 – 6 weeks	1868.6[b]	1897.2[ab]	1961.9[a]	38.6	*
Feed consumption (g):					
0 – 3 weeks	1144.0	1150.2	1138.1	29.7	NS
3 - 6 weeks	2658.8	2714.9	2685.5	41.8	NS
0 – 6 weeks	3802.8	3865.1	3823.6	52.3	NS
Feed conversion ratio:					
0 – 3 weeks	1.88	1.86	1.82	0.02	NS
3 - 6 weeks	2.11[a]	2.12[a]	2.01[b]	0.04	*
0 – 6 weeks	2.04[a]	2.04[a]	1.95[b]	0.03	*

NS Not significant * Significant at 0.05 ** Significant at 0.01

[a,b] Within the same rows, means that have similar letter(s) are not significantly different at 0.05

Table (6): Effect of AMLE supplementation in drinking water on carcass characteristics of broiler chicks.

Items	Levels of AMLE in drinking water (ml/liter)			S.E.	Significance
	0	10	20		
Slaughter weight	1903.0	1928.7	2005.6	45.4	NS
Carcass weight	1344.8[b]	1491.8[ab]	1613.3[a]	79.4	*
Dressing%	77.2[a]	70.9[b]	80.5[a]	1.43	*
Liver %	2.8	2.5	3.2	0.35	NS
Heart %	0.9	1.2	1.1	0.05	NS
Gizzard%	1.9	1.9	2.0	0.25	NS
Giblets %	5.6	5.7	6.3	0.61	NS
Abdominal fat %	0.2	0.2	0.2	0.02	NS

NS Not significant * Significant at 0.05 ** Significant at 0.01

[a,b] Within the same rows, means that have similar letter(s) are not significantly different at 0. 05

Table (7): Effect of AMLE supplementation in drinking water on plasma hematological parameters of broiler chicks

Items	Levels of AMLE in drinking water (ml/liter)			S.E.	Significance
	0	10	20		
WBC's (10^3/µL)	76.41	77.73	74.13	0.74	NS
LYM %	72.16	71.62	74.24	0.63	NS
MON%	11.34	13.65	12.53	0.34	NS
NEU%	13.23	14.71	13.00	0.32	NS
HGB (g/dL)	16.18^b	20.44^a	19.24^a	0.28	*
HCT%	27.53^b	30.51^{ab}	33.03^a	0.54	*
MCV (µm^3)	102.08	110.44	109.57	1.71	NS
MCH (pg)	66.18	68.25	67.17	1.08	NS
PLT (10^3/µL)	12.74	11.72	13.33	0.18	NS
RBC's (10^6/µL)	2.74^b	2.96^{ab}	3.02^a	0.07	*

NS Not significant * Significant at 0.05 ** Significant at 0.01

^{a,b} Within the same rows, means that have similar letter(s) are not significantly different at 0. 05

Table (8): Effect of AMLE supplementation in drinking water on liver function of broiler chicks.

parameters	Levels of AMLE in drinking water (mL/liter)			S.E.	Significance
	0	10	20		
TP (mg/dL)	4.25^b	6.85^a	6.35^a	0.34	*
ALB(mg/dL)	1.88	2.85	2.46	0.08	NS
GL (mg/dL)	2.37	4.00	3.90	0.07	NS
A/G ratio	0.79	0.71	0.63	0.03	NS
AST (IU/L)	19.50^a	16.10^{ab}	14.00^b	1.02	*
ALT (IU/L)	28.00^a	12.08^b	15.00^b	1.17	**
LDH (mg/dL)	219.13	239.00	193.51	9.98	NS
TB(mg/dL)	0.29	0.31	0.50	0.04	NS
ALP (mg/dL)	88.10	94.50	87.00	19.12	NS
Createnine	0.48	0.41	0.36	0.05	NS
(mg/dL)	18.95	16.15	14.98	1.07	NS
Urea (mg/dL)	9.94	10.55	6.74	0.86	NS
Uric acid (mg/dL)	195.63^a	88.00^a	176.67^b	6.63	*
TC (mg/dL)	115.57^a	66.50^b	61.50^b	7.85	**
TG (mg/dL)					

NS Not significant * Significant at 0.05

^{a,b} Within the same rows, means have that similar letter(s) are not significantly different at 0. 05

Table (9): Effect of AMLE supplementation in drinking water on plasma antioxidant activity and immunological indices of broiler chicks.

parameters	Levels of AMLE in drinking water mL/liter)				
	0	**10**	**20**	**S.E.**	**Significance**
SOD (U/ml)	35.1[b]	33.0[b]	66.0[a]	2.75	**
MAD (mmo/ml)	51.1[b]	58.0[b]	73.0[a]	3.94	*
TAC (U/ml)	1.16[b]	1.05[b]	1.76[a]	0.08	*
GSH (ug/ml)	88.9	81.5	79.5	1.88	NS
NO (U/ml)	172.6	129.5	151.0	7.01	NS
CAT (ug/ml)	250.7	233.0	268.0	9.78	NS

NS Not significant * Significant at 0.05 ** Significant at 0.01
[a,b] Within the same rows, means that have similar letter(s) are not significantly different at 0. 05

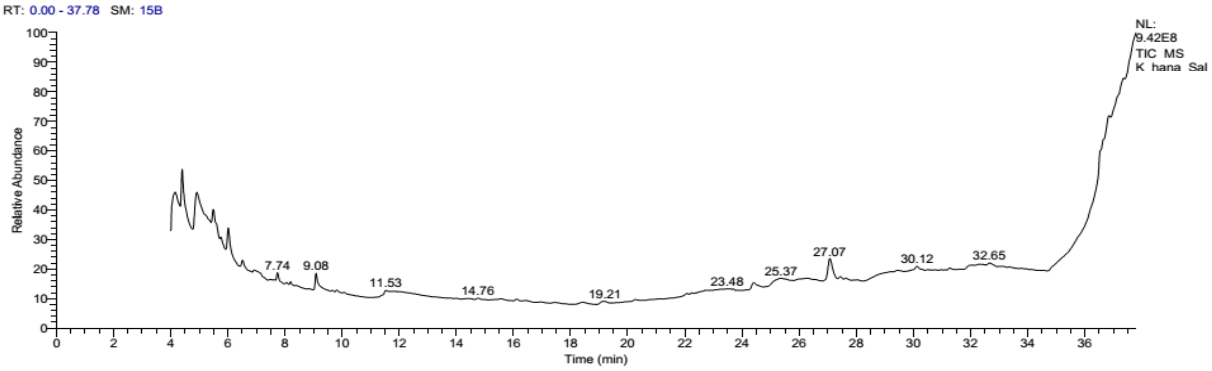


Fig. (1): GC-MS Chromatogram of aqueous mango leaves extract (AMLE)

REFERENCES:

Ahmed SKH. 2019. Egg yolk, fatty acids, blood parameters and some reproductive measurements of Japanese quail supplemented with chia seeds (*Salvia hispanice* ***L.).*** Int J Poult Sci.18:129–35. https://scialert.net/abstract/?doi=ijps.2019. 129.135

Alvarenga RR, Zangeronimo MG, Pereira LJ, Rodrigues PB, Gomide EM 2011. Lipoprotein metabolism in poultry. Worlds J Poult Sci. 67:431–40. https://doi.org/10.1093/jn/127.5.805S

Attia YA, Harthi MA 2015. Nigella seed oil as an alternative to antibiotic growth promoters for broiler chickens. Eur Poult Sci. 79:1–12. DOI: 10.1399/eps.2015.80

Bracca A, Fico G, Morelli I, De-Simone F, Tome F, Tommasi ND 2003. Antioxidant and free radical scavenging activity of flaonol glycosides form different Aconitum species. J Ethnopharmmacol.. 86:63–7. https://doi.org/10.1016/S0378-8741(03)00043-6

Cao FL, Zhang XH, Yu WW, Zhao LG, Wang T 2012. Effect of feeding

fermented Ginkobiloba leaves on growth performance, meat quality, and lipid metabolism in broilers. Poult Sci. 91:1210–21. https://doi.org/10.3382/ps.2011-01886

Dos Santos da Rocha PDS, de Araújo Boleti AP, Do Carmo Vieira M, Carollo CA, Da Silva DB, Estevinho LM, Dos Santos EL, De Picoli Souza K 2019. Microbiological quality, chemical profile as well as antioxidant and antidiabetic activities of Schinus terebinthifolius Raddi. Comp Biochem Physiol C: Toxicol Pharmacol. 220:36–46. https://doi.org/10.1016/j.cbpc.2019.02.007

Duncan DB 1955). Multiple ranges and multiple F test. Biometrics;11:1042.

Economic Research Service/USDA website 2001. Patterns of world poultry consumption and production.

Feriani A, Tir M, Hamed M, Sila A, Nahdi S, Alwasel S, Tlili N 2020. Multidirectional insights on polysaccharides from Schinus terebinthifolius and Schinus molle fruits: physicochemical and functional profiles, in vitro antioxidant, anti-genotoxicity, antidiabetic, and antihemolytic capacities, and in vivo anti - inflamm atory and anti - nociceptive properties [International Journal] of Biological Macromolecules;165:2576–87. https://doi.org/10.1016/j.ijbiomac.2020.10.123

Fernández-Ponce MT, Casas L, Mantell C, Martínez de la Ossa E 2015. Use of high pressure techniques to produce Mangifera indica L. leaf extracts enriched in potent antioxidant phenolic compounds. Innov. Food Sci. Emerg. Technol.;29:94–106. DOI:10.1016/j.ifset.2015.04.006

García, D.; Leiro ,J; Delgado, R.; Sanmartín, M.L. and Ubeira, F.M. 2003.

Mangiferaindica L. extract (Vimang) and mangiferin modulate mouse humoral immune responses. Phytother Res.(17):1182-1187.

Garrido G, González D, Lemus Y, García D, Lodeiro L, Quintero G, Delporte C, Núñez-Sellés AJ, Delgado R 2003. In vivoand in vitroanti-inflammatory activity of Mangifera indica L. extract (Vimang). Pharmacol Res 2004;50:143–9. https://doi.org/10.1016/j.phrs.12.003

Ghareeb MA, Hussein AS, Madkour HMF, Laila AR, Mona AM, Amal MS 2013. Glob J Pharmacol;7:486–97. https://doi.org/10.1006/abio.1999.4019

Islam MR, Mannan MA, Kabir MHB, Islam A, Olival K 2010. Analgesic, anti-inflammatory and antimicrobial effects of ethanol extracts of mango leaves. J Bangladesh Agric Univ;8:239–44. http://purl.umn.edu/208493

Jabri J, Kacem H, Yaich H, Abid K, Kamoun M, Rekhis J, Malek A 2017. Effect of olive extract supplementation in drinking water on zootechnical performance and cecal microbiota balance of broiler chickens. J New Sci;4.

Kanwal Q, Hussain I, Latif Siddiqui H, Javaid A 2010. Antifungal activity of flavonoids isolated from mango (Mangifera indica L.) leaves. Nat Prod Res;24:1907–14. https://doi.org/10.1080/14786419.2010.488628

Mahaswaran R, Devepaul A, Muralidhalan S, Velmurugan, Igancimuthu S 2008. Haematological studies of fresh water fish, Clarais

hatrachus L. exposed to mercuric chloride. Int J Integr Biol ;245.

Mujeeb F, Bajpai P, Pathak N 2014. Phytochemical evaluation, antimicrobial activity, and determination of bioactive components from leaves of Aegle marmelos. Biomed. Res. Int.;2014:497606. https://doi.org/10.1155/2014/497606

Muruganandan S, Srinivasan K, Gupta S, Gupta PK, Lal J 2005. Effect of mangiferin on hyperglycemia and atherogenicity in streptozotocin diabetic rats. J Ethnopharmacol;97:497–501. https://doi.org/10.1016/j.jep.2004.12.010

Orwa C, Mutua A, Kindt R, Jamnadass R, Simons A 2009. Agrofores tree database: a tree reference and selection guide version 4.0. Nairobi, Kenya: World Agroforestry Centre;.

Pereira CG, Meireles MAA 2007. Evaluation of global yield,composition, antioxidant activity and cost of manufacturing of extracts from lemon verbena (Aloysia triphylla [L'hérit.] Britton) and mango (Mangifera indica L.) leaves. J Food Process Eng;30:150–73. https://doi.org/10.1111/j.1745-4530.2007.00100.x

Pourakbari M, Seidavi A, Asadpour L, Martínez A 2016. Probiotic level effects on growth performance, carcass traits, blood parameters, cecal microbiota, and immune response of broilers. Ann Braz Acad Sci:1–11. https://doi.org/10.1590/0001-3765201620150071

Prieto P, Pineda M, Aguilar M 1999. Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex: specific application to the determination of vitamin E. Anal Biochem;269:337–41. https://doi.org/10.1006/abio.1999.4019

Reda FM, El-Saadony MT, Elnesr SS, Alagawany M, Tufarelli V 2020b. Effect of dietary supplementation of biological curcumin nanoparticles on growth and carcass traits, antioxidant status, immunity and caecal microbiota of Japanese quails. Animals (Basel);10:754. https://doi.org/10.3390/ani10050754

SAS Institute(2003): SAS User's guide: statistics. SAS Institute, ary, NC.

Singleton VL, Rossi I 1965. Colorimetry of total phenolic with phosphomolybdic-phosphotumgstic acid reagents. Am J Enol Vitic;16:144–58.

Wezyk S, Poltowicz K, Sosnowka-Czajka E 2000. Effect of replacing antibiotic growth stimulants with herbs on performance and meat quality of chicken broilers. Proceedings of the of XXI world's poultry Conf.,20-24 Aug., 2000. Montreal, Canada; 2000.

Zhang YN, Wang J, Qi B, Wu SG, Chen HR, Luo HY, Yin DJ, Lü FJ, Zhang HJ, Qi GH 2017. Evaluation of mango saponin in broilers: effects on growth performance, carcass characteristics, meat quality and plasma biochemical indices. Asian-Australas J. Anim. Sci.;30:1143–9. https://doi.org/10.5713/ajas.16.0847

Zhishen J, Mengcheng T, Jianming W 1999. The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. Food Chem.;64:555–9. https://doi.org/10.1016/S0308-8146(98)00102-2

الملخص العربى
تأثير اضافة مياه الشرب بمستخلص أوراق المانجو على أداء النمو ومضادات الأكسدة في البلازما والمؤشرات البيوكيميائية لدجاج التسمين

إيناس محمود عباس[1] و ايمان الحسينى يس[2]

1 قسم الانتاج الحيوانى و الداجنى - كلية الزراعة- جامعة المنيا- المنيا - مصر
2 قسم الكيمياء الزراعية -كلية الزراعة- جامعة المنيا – المنيا – مصر

ادى الطلب المتزايد على المواد الكيميائية الطبيعية فى تغذية دجاج التسمين للحاجة الى تطوير منتجات طبيعية مستدامة و جديدة لتحل محل المواد الكيميائية الصناعية الغير صديقة للبيئة . لذا هدفت هذه الدراسة الى تقييم التركيب الكيميائى و النشاط المضاد للاكسدة للمستخلص المائى لاوراق المانجو و معرفة مدى امكانية استخدامه كإضافة لمياه الشرب لرفع مناعة كتاكيت التسمين من خلال تقييم اداء النمو و مواصفات الذبيحة و القياسات البيوكيميائية للبلازما. تم تقسيم عدد 216 كتكوت تسمين روس 303 عمر يوم غير مجنس عشوائيا الى ثلاث مجموعات تحتوى كل مجموعة على 6 مكررات بواقع 12 كتكوت للمكررة . قدمت مياة الشرب للمجموعة الاولى (الكنترول)بدون اضافات اما الثانية و الثالثة تم اضافة 10 و 20 مل / لتر من مستخلص اوراق المانجو على التوالى . اظهرت النتائج ان المستخلص المائى لاوراق المانجو له نشاط على كمضاد للاكسدة . التحليل الكروماتوجرافى وضح احتواء المستخلص على 10 مركبات اهمها 3-(Prop-2-enoyloxy) dodecane (27.93%),Hexadecanoic acid, methyl ester (13.68%), 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl (10.41%), Docosanoic acid, methyl ester (9.53%), n-Hexadecanoic acid (7.84%).

اوضحت النتائج ان الطيور فى المجموعة الثانية و الثالثة اظهرت تحسن معنوى فى وزن الذبيحة و نسبة التصافى و الصفات الهيماتولوجية و البيوكيميائية و مضادات الاكسدة مقارنة بالكنترول. توصى النتائج باستخدام المستخلص المائى لاوراق المانجو كمنشط للنمو و مقوى للجهاز المناعى لكتاكيت التسمين