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A COMPARATIVE STUDY BETWEEN THE EFFECTS OF GARLIC EXTRACT AND JERUSALEM ARTICHOKE TUBER MIXTURE AS A SOURCE OF PREBIOTIC AND PROBIOTIC (BIOMINE) ON THE PERFORMANCE AND HEALTH OF BROILER

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ABSTRACT
The present study conducted to evaluate and compare between garlic extract and Jerusalm artichoke tuber powder (JAT) as a source of prebiotic and the probiotic (Biomine) on the performance and health of broiler. Three hundred one-day old chicks (Hubbard) with equal numbers were randomly allocated to five groups (three replicates for each group). As following: no supplement (control), garlic extract and (JAT) at 35ppm/kg, garlic extract and (JAT) at 70pp/kg, Biomine 30ppm/kg, Biomine 60ppm/kg respectively. The results obtained that the diet with garlic extract and Jerusalem artichoke tuber powder (JAT) at different levels (0.035 and 0.070%) and (0.5 and1%) probiotic improved body weight gain, feed efficiency ratio and decreased the mortality rate when compared with control group. Also significant decrease ($p<0.05$) occurred in serum total cholesterol level for all groups with different levels when compared with control

KEY WORDS: Garlic extract, Jerusalm artichoke tuber, probiotic, prebiotic, feed additives.

INTRODUCTION

Medicinal plants have been used for centuries and have become as a part of complementary medicine worldwide because of their potential health benefits. Some of their metabolites have been successfully used directly in the treatment and prevention of infectious disease and cancer, or indirectly by stimulating the immune system (Gomez-Flores *et al*., 2008). Medicinal plants containing with high antioxidant property play an important role in the prevention of various degenerative diseases (Hakim *et al*., 2007).Recently, medicinal and aromatic plants have received much attention in several fields such as agro alimentary, perfumes, pharmaceutical industries and natural cosmetic products (Khorasaninejad *et al*., 2010).

Garlic (*Allium sativum*) is a perennial bulb-forming plant that belongs to the genus *Allium* in the family Liliaceae, which has been used for centuries as a flavouring agent, traditional medicine, and a functional food to enhance physical and mental health. Garlic is an important medicinal herb extensively cultivated in many countries and has played an important dietary function as well as medicinal role for centuries. Studies on garlic as an alternative of growth promoter in livestock production were conducted and its beneficial effects on growth, digestibility and carcass traits leading toincreased weight gain, feed efficiency, protein efficiency ratio (PER) and specific growth rate (Bampidis, *et al*., 2005).The crude garlic extract reduce the serum cholesterol concentration without any adverse effects on production performance of broiler's (Yoo *et al*., 2011).The garlic (*Allium sativum*) has been widely investigated and is well documented as antibacterial lead to improve performance and development of the gastrointestinal tract (Sivam, 2001). The crude extract of garlic enhances immunity, promotes livestock and poultry, healthy growth, infirmity, disease resistance increase, and increases the amount of laying, can promote the growth and improves the survival rate. Garlic had medicinal uses like lower cholesterol,it also prevents dangerous blood clots, protects LDL cholesterol and the endothelial lining of the arterial system against oxidation, reduces blood pressure, prevents cancer, and protects against bacterial and fungal infections. It inhibits platelet aggregation; and it displays reliable fibrinolytic and hypotensive properties. All of these effects lead to improved cardiovascular health. They also inhibit biosynthesis of prostacyclin in rat aorta from labelled arachidonic acid. Garlic inhibits platelet aggregation in human and animal subjects. Antiplatelet inhibitors have been isolated from homogenates of fresh garlic and were shown to inhibit both platelet aggregation and thromboxane synthesis (Freeman and Kodera, 1995).

(*Helianthus tuberosus* L.) plays as an important role in decreasing serum cholesterol colon by beneficial bacteria and act as a prebiotic, and low density lipoprotein (LDL) cholesterol without affecting serum triglycerides (Anderson and Hanna, 1999). In addition *Helianthus tuberosus* L. increases food intake and can be used as functional food lead to improve the total body weight and feed efficiency ratio. JAT powder contains 85.78% total carbohydrate, 7.4% crude protein, 0.72% ether extract, 9.82% crude fiber and 5.53% ash (Khorasaninejad *et al*., 2010). JAT increases fecal lipid excretion and decreasing lipid absorption (Werk *et al*., 1994).

Helianthustuberosus is used to improve the health, the application of functional food additives. In addition its richness with inulin and fructo-oligosaccharides (FOS) which are considered as prebiotics, has gained increased interest (Bosscher *et al*., 2006). Jerusalem artichoke is the

ideal food for slimming and eliminating excess water and toxins. It has the capacity to work on the metabolism by producing energy and a feeling of being satiated, without increasing glycerin levels. The active principle responsible for these phenomena is Inulin, a carbohydrate well tolerated by the pancreas. Inulin works in synergy with other elements of the plant, such as the bitter properties, the proteins, soluble fibers and basic minerals, to exert a regulating effect on the body's metabolism (Cieslik *et al*., 2005).

MATERIALS AND METHODS

Watery crude Garlic extraction was used the garlic content extract was 2gm garlic/ml. The garlic extract was prepared by crushing about 1000gm garlic in grinder and was kept in distilled water (for watery extract) in a beaker at room temperature, packed in muslin cloth bags for overnight covered with Petridis. Then the solution was filtered and evaporated (Kamla *et al*., 2011).Experiments were carried out at the poultry farm of veterinary collage, Baghdad University. Three hundred, day old broiler (Rose 308) chicks were divided into 5 treatment groups, 60 birds each. Treatments were further subdivided into 3 replicates, 20 birds each. The treatments were divided as follows: Diet (1) using basal diet free from herbal plants kept as control. Diets (2, 3, 4 and 5) using basal diet plus (0.25, 0.50, 0.75 and 1%) a mixture of Hrp and Bp. (250, 500, 750 and 1000) gm/100kg of feed respectively. Chicks were reared in floor pens (1.5m×1.5m) with a thick litter system of wood shavings to about 7 cm in height. The feeding program consisted of starter diet that have been used until 21 days of age and a finisher diet until 42 days of age. All diets of each period were prepared with same composition. Diets were formulated to meet or excess requirements according to the National Research Council (NRC, 1994) for broilers at this age. The feed and water are provided *ad libitum* during the experiment. Two phases of feeding program were involved in supplying: starter (1-21 days of age) and finisher (22-42 days of age). The chemical compositions of the experimental basal diets are shown in table (1).

TABLE 1: Composition of the experimental basal diets

Ingredient (%)	Starter 1-21 day	Finisher 22-42 day
Yellow corn	51	53.3
Soybean meal (45% protein)	30	25
Wheat	13.8	15
Oil	1	2.5
premix*	2.5	2.5
Salt	0.3	0.3
Methionine	0.1	0.1
Lysine	0.1	0.1
Di-Calcium phosphate	1.2	1.2
Calculated chemical analysis		
ME(Kcal/kg)	3000	3086
Crude protein %	21.3	19.5
Calcium%	0.69	0.52
A viable phosphor	0.74	0.69
Methionine	0.33	0.31
Lysine	1.19	1.08

*premix: (2.5%) provided the following (per Kg of complete diets) 367500IU,133500IU Vit.D3,1920 mg, Vit.E,83.42 Vit.K3,50mg Vit.B1,150 Vit. B2, 500mg Vit. B3,177,5 mg Vit.B6,0.8mg Vit B12,600mg Vit.pp,24.5 mg folic acid, 27 mg Biotin,5767.5mg choline,2667mg Fe,333.75mg Cu,3334.06 mg Mn, 203mg Co 2334.38 mg Zn,100.75 mg Ca,10 mg Se,65446.46 mg Ph,36667.5 mg DL-Methionine, 200.02 mg Ethoxyquin, 50mg Flavophospholipol, 30g fish meal, 1800 g wheat bran.

Chicks were vaccinated against the most common disease such as Newcastle Disease (ND) and infectious Bronchitis (IB). Body weight was determined throughout the feeding periods. Feed intake was recorded for the above periods. At the end of the experiment, three chicks from each replicate were randomly selected and weighed to obtain live body weight. (LBW). Chicks were slaughtered using a sharp knife for complete bleeding and feature were plucked. Head, internal viscera and shanks were removed. Carcass was left for one hour to remove excess water and allowed for overnight cooling at 4± 2 C^o then weighed. Dressing percentage carcasses was calculated free from giblets and the included organs were weighed separately as percentage of the carcass weight. Blood samples were taken from the brachial vein using a syringe. Sample were used for the measurement of various hematological parameters including PCV,WBC and RBC count, hemoglobin (Hb) concentrations and hetrophile-lymphocytes ratio, (H/L) glucose and cholesterol concentration. Data were analyzed using the General Linear Model Procedure of SAS, (2001). Duncans multiple range tests was used to detect the differences ($p<0.05$) among different group means.

RESULTS AND DISCUSSION

Table (2) reveals the effect of different levels of probiotic and prebiotic to the broiler diet on the broiler diet on the productive traits (body weight, feed consumption, feed conversion ratio, edible giblets , dressing percent and mortality rate percentage, among treatments. With regards to T1 (control), T3, T4 and T5 showed a highly significant ($p<0.05$) increasing in body weight and feed consumption traits in comparison with (T2). (T1) led to lowest value with regards to the most of characteristics productive

value. These may be due to the fact that garlic extract and Jerusalem offered the greatest benefits of containing high levels of allicin, ajoene, S-allylcysteine, diallyl disulfide, S-methylcysteine sulfoxide (Chi *et al*., 1982, Lee *et al*., 2012). The Inulin fermentation in the colon by beneficial bacteria which has been associated with enhancing the gastrointestinal system and immunity system. In addition, it has been shown that it increases the absorption of calcium and magnesium. However the synergistic action of both (garlic extract and Jerusalem) had led to improve the digestive canal status and attenuation to the number of microbes in the intestine to cause an increase in the available energy for growth and an improvement in the performance.

Meanwhile (T5) showed generally a high value of dressing percent in comparison with rest treatments. Whereas all treatments revealed no significant difference among them in accordance with edible giblets (Heart%, Gizzard% and liver %) traits. These result assure that the addition of probiotic and prebiotic diet had no significant effects on these traits. (Akinleye *et al*., 2008).

TABLE 2: Effect of different levels of probiotic and prebiotic on the performance of broiler.

Ingredients	Control	Prebiotic		Probiotic	
	0.00	garlic 35ppm/kg	JAT 70ppm/kg	(Biomine) 30ppm/kg	(Biomine) 60ppm/kg
parameters	T1	T2	T3	T4	T5
Initial body weight (g/brid)	40±0.36	39.9±0.45	40.0±0.51	38.7±0.62	41.0±0.38
Final body weight(g/brid)	1911.8±102.3^{c}	2023.7±93.9^{b}	2118.9±70.4^{a}	2115.5±66.8^{a}	2123.3±69.7^{a}
Average body weight gain(g/brid)	1871.7±98.7^{c}	1983.8±96.8^{b}	2078.9±102.3^{a}	2076.8±99.8^{a}	2082.3±94.6^{a}
Average feed intake(g/brid)	3762.1±106.7^{c}	3927.9±180.3^{a}	3908.3±156.7^{b}	3821.3±183.8^{c}	3998.0±123.4^{a}
Feed conversion(g.feed/g.weight)	2.01±1.20^{a}	1.98±0.91^{a}	1.88±0.92^{bc}	1.84±0.82^{c}	1.92±0.79^{b}
Edible parts					
Heart %	0.69±0.01	0.74±0.02	0.74±0.01	0.77±0.03	0.76±0.3
Liver%	3.72±0.03	3.68±0.05	3.71±0.04	3.73±0.04	3.12±0.05
Gizzard%	3.14±0.01	3.19±0.02	3.27±0.01	3.71±0.05	3.41±0.03
Dressing percent	71.22±0.02	72.6±0.02	74.71±0.05	76.02±0.02	78.51±0.05
mortality	8.3±0.03	6.3±0.03	2.7±0.02	3.9±0.03	2.0±0.02

*Small letters means in the same raw different subscript are different ($p<0.05$).

The hematological parameters exhibited significant ($p<0.05$) difference between treatments compared with the control group (table 3). Treatment T2, T3, T4 and recorded the highest values in all parameters (Hb, PCV%, WBC and RBC). These results are in agreement with the findings of Elnagar *et al*., (2003) who reported an increase in RBCs count for birds fed diet with garlic extract compared to the control birds. At the same time these results in agreement with Al-Kassie, (2008) who reported that use of Jersalem in the diet of broiler was improved PCV%, Hb and RBCs compared with control group.

Table (3) Effect of different levels of probiotic and prebiotic on the some hematological and biochemical values of broiler.

Treatments	Control	Prebiotic		Probiotic	
	T1	0.5%Garlic extract and Jersalem	1%Garlic extract and Jersalem	0.5%Biomine	1%Biomine
parameters		T2	T3	T4	T5
Hematological values					
H/L Ratio	0.400±0.04	0.0352±0.05	0.380±0.03	0.372±0.04	0.342±0.03
Hb(gm/100ml)	10.6±0.43	11.8±0.61	12.9±0.47	13.2±0.58	13.7±0.41 ^{a}
4WBC(10^3/mm^3)	3.88±0.06 ^{C}	4.31±0.04 ^{b}	4.49±0.06 ^{b}	4.58±0.05 ^{a}	4.60±0.0 ^{a}
RBC(10^6/mm^3)	6.3±0.06 ^{b}	6.8±0.01 ^{a}	6.9±0.03 ^{a}	7.1±0.05 ^{a}	4.60±0.04 ^{a}
PCV%	32.6±0.9 ^{c}	34.8±0.8 ^{c}	36.9±0.9 ^{a}	37.4±0.4 ^{a}	38.2±0.7 ^{a}
Biochemical values					
Cholesterol(mg/dl)	157.0±3.2 ^{a}	122.8±5.8 ^{c}	115.7±4.1 ^{b}	116.7±3.7 ^{b}	112.5±2.3 ^{b}
Total protein	3.81±0.07 ^{b}	3.79±0.05 ^{c}	4.57±0.09 ^{a}	4.78±0.06 ^{a}	4.89±0.07 ^{a}

Small letters means in the same raw different subscript are different significantly($p<0.05$).

At the same time all treatments showed no significant effect on H/L ratio as compared to the control group. This referred to the good management and healthy diet for all treatments. Craig (1999) mentioned that herbs and their essential oils have a vital role in cholesterol lowering properties and in the protection against cancer. Other researcher found that the herbs have an effect on plasma lipids other than cholesterol (Cooke *et al*., 1998).

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