



Effect of Garlic powder Supplementation level at different growth stages on Broiler performance

Nasr Al-Rabadi^{1*}, Razan Haddad², Marwan A. Al-Hijazeen³, Mazen Massoh⁴, Jafar M.I. Alqudah⁵, Anwar G. Jiries⁶, Muhammad H. Alu'datt⁷, Saddam A. Al-Dalain⁸, Rasha S. Al-Dmour⁶, Farh M. Al-Nasir⁹, Amal Mayyas¹⁰, Ghaid J. Al-Rabadi^{3*}

¹Department of Pharmacology, Faculty of Medicine, Jordan University of Science and Technology, Irbid, Jordan, 22110.

²Department of Pharmaceutical Technology, Faculty of Pharmacy, Jordan University of Science and Technology, Irbid, Jordan, 22110.

³Department of Animal Production, Faculty of Agriculture, Mutah University, Al-Karak 61710, Jordan

⁴Department of Animal Production, Faculty of Agriculture, Al-Baath University, Homs, Syria.

⁵Food Directorate, Jordan Food and Drug Administration, Amman, 11181/811951, Jordan.

⁶Faculty of Science, 61710, Mutah University, Karak, Jordan

⁷Department of Nutrition and Food Technology, Faculty of Agriculture, Jordan University of Science and Technology, P.O. Box 3030, Irbid, 22110, Jordan

⁸Al-Shoubak University College, Al-Balqa Applied University, Al-Salt, 19117, Jordan

⁹Department of Plant Production, Faculty of Agriculture, 61710, Mutah University, Karak, Jordan

¹⁰Department of Pharmacy, Faculty of Health sciences, American University of Madaba/ 11821 Madaba, Jordan

*Corresponding authors: ghaid.rabadi@mutah.edu.jo(or) nnalrabadi@just.edu.jo.

ABSTRACT

The current investigation was conducted to study the effect of periodically use of garlic powder on some productive performance (mortality, feed intake, live body weight gain, feed consumption, and feed conversion ratio). Two hundred and ten Ross broilers (1 day old) were raised during the experimental period for six weeks. Broilers were divided into ten groups and were offered corn-soybean-based diets for two growth stages (starter and finisher stages). All chicks were distributed into ten experimental treatments with three replicates for each treatment and seven chicks in each replicate. The control treatment group received basal diet without supplementation of garlic powder. Three treatment groups were offered basal diet supplemented with 0.5, 1, and 1.5% garlic powder during the starter stage (i.e 1-21 days). Three treatment groups received a control diet for 21 days and then offered 0.5, 1, and 1.5% of garlic powder during the finisher stage (i.e 22-42 days). The last three treatment groups received a basal diet supplemented with 0.5, 1, and 1.5% garlic powder during both starter and finisher stages (i.e from 1-42 days). The results of this study showed that feeding garlic powder at higher inclusion rate (i.e 1.5%) significantly reduce feed intake compared to broilers fed garlic powder at low inclusion level (0.5%) and broilers in the control group. However, feeding garlic powder at higher inclusion level (i.e 1.5%) significantly increased average gain and improved feed conversion ratio among the other feeding treatments. It can be concluded that the positive effect of feeding garlic diet was more pronounced during the finisher stage (day 22-42) or when garlic powder fed during all the experimental period (i.e day 1-42). Finally, this study paves the way for the use of garlic powder or its constituents in the clinical settings where effective nutrition and increasing the human body weight may be necessary.

Keywords: Mortality, feed intake, live body weight gain

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INTRODUCTION

Different feeding strategies have been used by animal nutritionists to reduce using antibiotics and synthetic additives in poultry feed [1-3]. These feeding strategies include using prebiotics, probiotics, whole grain feeding, using enzymes, organic acids, and natural plant products and/or their extracts [4-7].

Researchers are more interested in using natural plant additives because it considers safer alternatives especially for human consumption [1,8, 9]. Synthetic and antibiotics additives may accumulate (residual) in the animal tissues which may cause a possible toxicological and carcinogenic effect on human health [10, 11]. So, the new approach is to decrease using these synthetic supplements and to be replaced by adding natural alternatives [1, 12]. Several medicinal plant additives were investigated in poultry feed such as oregano, sage, rosemary, garlic, and others [5, 6, 13-15]. Among these natural products, garlic considers an excellent dietary approach to achieve better growth, health, meat quality, immunity, and feed conversion [16, 17]. Garlic (*Allium sativum*) is widely used for human consumption mainly as a spice, and in food preparation recipes. Many human studies showed that garlic contains chemical constituents that can help in the treatment or prevention of cancer, diabetes, blood pressure, atherosclerosis, and hyperlipidemia [16, 18]. Several compounds (sulfur volatile active component) in garlic extract responsible on their bioactive (antibacterial, anti-inflammatory and antioxidant properties) effect such as Allicin (organosulfur compound, the family of Alliaceae), allin, ajoene, diallylsulfide, dithiin, S-allylcysteine [16, 19-21]. In animal nutrition, many studies showed that garlic possesses many useful properties that can enhance overall animal performance. This is due to the presence of unique phytochemicals that have a strong action against bacterial and fungal threats, and oxidative stress which can affect overall animal performance [22-24]. Different strategies have been investigated in using garlic in poultry nutrition such as using different inclusion levels in the diet [15, 17, 19], different garlic forms (powder or extract) [19, 25], feeding garlic alone or combined with other herbs [26], garlic feeding duration [22] and garlic addition form/ method (through diet or drinking water) [17, 27]. However, different poultry growth responses to garlic feeding have been reported [22]. The main objective of the current study was to examine the influence of broiler growth phase and garlic inclusion level on broiler growth weight, feed intake, feed conversion, and mortality rate. Hopefully, the outcomes of this study will aid in establishing the ideal feeding strategy in incorporating garlic powder in the broiler diet and paving the way for more clinical application of this natural product in human health.

MATERIAL AND METHODS

Birds and Diet formulation

Two hundred and ten Ross broilers (1 day old) were raised during the experimental period for six weeks. Broilers were divided into ten groups and were offered corn-soybean-based diets for two growth stages (starter and finisher diets) as shown in Table 1. All chicks were distributed into ten experimental treatments with three replicates for each treatment and seven chicks in each replicate. The control treatment group received basal diet without supplementation of garlic powder. Three treatment groups were offered basal diet supplemented with 0.5, 1, and 1.5% garlic powder during the starter stage (1-21 days). Three treatment groups received a control diet for the first 21 days and then offered 0.5, 1, and 1.5% of garlic powder during the finisher stage (22-42 days). The last three treatment groups received a basal diet supplemented with 0.5, 1, and 1.5% garlic powder during starter and finisher stages (i.e from 1-42 days). All diets were formulated to be approximately isocaloric and is nitrogenous and offered *ad libitum*. The composition of diet ingredients and chemical compositions/analysis are shown in Table 1. Broilers were exposed to continuous light in the open housing system, reared in floor cages equipped with trough drinkers and feeders.

Data Measurement

Mortality percentage, broiler body weight gain, feed intake, and feed conversion ratio were measured as reported by Al-Rabadi *et al* [28].

Data analysis

Statistical analysis was performed using Statistical Analysis System (SAS) software programs (v.9.1, SAS Institute, Cary, NC). A least significant difference (LSD) was used for mean separation. For all analyses, the value of α was set to 0.05, the level used for statistical significance. All data were presented as means (\pm SD).

RESULTS AND DISCUSSION

The results of this study showed that feeding different garlic powder levels at different feeding stages significantly eliminated any mortality incidence when compared to broilers fed control diets at different production stages (Table 2). In agreement with that, the inclusion of garlic powder in broiler diets have been reported to enhance immunity system through different mechanisms such as increasing total white blood cells [29] and by increasing the number of beneficial bacteria in the gut [17, 19, 22]. Those effects can reduce broiler infections and may have a role in decreasing mortality rates.

The effect of garlic feeding treatment on feed intake (gram) during different growth stages are presented in Table 3. The data also showed that feeding broiler garlic powder at different inclusion levels during the starter stage did not influence feed intake. However, the effect of feeding garlic diet was more pronounced during the finisher period. Feeding garlic powder at higher inclusion rates (i.e 1.5%) significantly reduces feed intake compared to broilers fed garlic powder at low inclusion levels (0.5%) and broilers in the control group. No significant difference in feed intake was noticed among broilers fed garlic powder when fed for the entire feeding experiment.

Table 4 shows the effect of garlic feeding treatment on average gain (gram) during different growth stages. It showed that feeding broiler garlic powder at different inclusion levels significantly influences average gain at different production stages. Feeding garlic powder at higher inclusion rates (i.e 1.5%) significantly increased average gain compared to other feeding treatments. Extended feeding period (i.e from day 1-42) of garlic powder markedly increased weight gain compared to broilers fed garlic powder during the second half period of the experiment (i.e finisher stage). For instance, Elkatcha *et al.* [19] found that various levels of garlic extract supplementation had no significant effect on body weight gain of broiler chicks at 1st, 2nd and 3rd weeks of age if compared to untreated diets. Furthermore, they found that dietary garlic extracts at 0.1, 0.2, and 0.3 mg/kg diet significantly improved final body weight gain compared to the control diet. However, the effect of adding a different level of garlic on broiler performance was varied and inconsistent [30-32].

Table 5 shows the effect of garlic feeding treatment on feed conversion ratio (FCR) during different growth stages. The result of the current study showed that feeding broiler garlic powder at different inclusion levels during the starter period did not influence FCR. However, the effect of feeding garlic diet was more pronounced during the finisher stage and when garlic powder was fed during all the experimental period (i.e day 1-42). Feeding garlic powder at higher inclusion levels (i.e 1.5%) significantly improved FCR compared to broilers fed other experimental diets during the finishing stage. A similar pattern was noticed when garlic powder fed at higher inclusion level (i.e 1.5%) during the whole experimental period (i.e day 1-42). Several studies have been reported to improve FCR and weight gain in broiler chicken (29, 32-35). This was in agreement with Makwana *et al.* [36] who investigated the effects of adding different levels (0, 0.1, and 0.5%) of garlic powder to basal diet on the growth performance of broiler chicks. The improvement in broiler growth performance could be attributed to the improvement in gastrointestinal morphology and enhancing the absorption capability of the small intestine through increasing in villus height, villus area [22, 37]. Other studies have reported that adding garlic to poultry diet can enhance the digestion of poultry feed [22, 38].

Finally, a better weight gain in garlic treatment might be due to the action of allicin which inhibits the growth of pathogenic bacteria by interfering with bacterial cell metabolism [39]. Also, garlic can enhance pancreatic enzyme activity [22] and activate the digestive process to improve the absorption of nutrients and ultimately the growth rate.

Table 1. Ingredients composition (%) of the experimental basal diet at the different growth stages.

Ingredients (%)	Growth stage	
	Starter (day 1-21)	Finisher (day 22-42)
Corn	56.85	61.9
Soybean meal	37.85	32.8
Soybean oil	1.4	1.4
Dicalcium phosphate	2.8	2.8
Salt	0.4	0.4
Methionine	0.2	0.2
Lysine	0.1	0.1
Choline	0.1	0.1
Vitamin mixture	0.1	0.1
Mineral mixture	0.1	0.1
Antifungal	0.05	0.05
Antococcida	0.05	0.05
Total	100	100
Chemical composition		
ME (kcal/kg)	2950	3030
Crude protein (%)	21.2	19

Table 2. Effect of feeding treatment on mortality (%) during the different growth stages

Garlic inclusion level (%)	Mortality (%)		
	Starter (day 1-21)	Finisher (day 22-42)	Total period (day 1-42)
0	4.73±8.2 ^{a*}	4.73±8.2 ^a	9.47±8.2 ^a
0.5	0 ^a	0 ^a	0 ^a
1	0 ^a	0 ^a	0 ^a
1.5	0 ^a	0 ^a	0 ^a
LSD	5.4	5.4	5.4

*Means within the same column with different superscript differ significantly (P < 0.05).

Table 3. Effect of garlic feeding treatment on feed intake (gram) during different growth stages.

Garlic inclusion level (%)	Feed intake (g)		
	Starter stage (day 1-21)	Finisher stage (day 22-42)	Total period (day 1-42)
0	1026.67±7.6 ^{a*}	3346.67±10.4 ^c	4373.33±17.6 ^b
0.5	1046.67±16.1 ^a	3200±34.6 ^b	4246.67±50.6 ^a
1	1058.33±32.2 ^a	3156.67±33.3 ^{ab}	4215.0±65 ^a
1.5	1065±21.8 ^a	3135±22.9 ^a	4200±36.1 ^a
LSD	40.22	51.05	86.2

*Means within the same column with different superscript differ significantly (P < 0.05).

Table 4. Effect of garlic feeding treatments on average gain (gram) during different growth stages.

Garlic inclusion level (%)	Average gain (g)		
	Starter (day 1-21)	Finisher (day 22-42)	Total period (day 1-42)
0	658.33±7.6 ^{b*}	1716.67±15.3 ^c	2375±22.9 ^c
0.5	656.67±11.5 ^b	1723.33±15.3 ^c	2380±26.5 ^{bc}
1	670±10 ^{ab}	1756.67±20.8 ^b	2426.67±30.6 ^{ab}
1.5	678.33±10.4 ^a	1796.67±15.3 ^a	2475±25 ^a
LSD	18.83	31.7	49.67

*Means within the same column with different superscript differ significantly

Table 5. Effect of garlic feeding treatments on feed conversion ratio during different growth stages.

Garlic inclusion level (%)	Feed conversion ratio		
	Starter (day 1-21)	Finisher (day 22-42)	Total period (day 1-42)
0	1.55±0.02 ^{a*}	1.95±0.04 ^a	1.84±0.03 ^a
0.5	1.59±0.02 ^a	1.86±0.04 ^b	1.78±0.04 ^b
1	1.59±0.04 ^a	1.79±0.04 ^c	1.74±0.06 ^c
1.5	1.57±0.03 ^a	1.75±0.06 ^d	1.70±0.05 ^d
LSD	0.056	0.025	0.0312

*Means within the same column with different superscript differ significantly

CONCLUSION

Overall, It can be concluded that the positive effect of feeding garlic diet on average gain and FCR were more pronounced during the finisher period (day 22-42) or when garlic powder fed at 1.5% inclusion during all the experimental period (i.e day 1-42). The outcomes of this study may aid in establishing the ideal feeding strategy in incorporating garlic powder in the broiler diet. As well, this study paves the way for the use of garlic powder or its constituents in the clinical settings where effective nutrition and increasing the human body weight are necessary.

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