The effect of adding garlic powder to the feed of local fatted rabbits on production parameters and blood biochemical traits

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Abstract

The aim was to evaluate the effect of the addition of garlic powder to the feed of young rabbits (kittens) on production parameters (incl. growth) and blood biochemical traits. Twelve local Iraqi rabbit kittens were selected (4-5 weeks of age) with an average weight of 330±5 grams. Each kitten was housed individually in a cage (1.5 x 2.0m) to ensure they had free access to feed and water. The kittens were divided into three groups of four according to three feeding trials (T1, T2 and T3) to evaluate production efficiency. The kittens were fed a controlled ration containing crude protein (16.6%) and metabolizable energy (2791Kcal/kg feed), with 1% *garlic powder* (dry weight; g/kg) added to the control ration of T2, and 2% to T3 (T1 was the control group, i.e. without *garlic powder*). The total weight gain, feed consumption rate and feed conversion ratio were calculated. Blood samples were obtained from all the kittens at the end of the trial period to determine specific blood biochemical traits, including total protein, triglyceride, cholesterol and glucose. At the end of experiment, the control ration was found to have a statistically significant ($p \leq 0.05$) effect on almost all production parameters and blood biochemical traits. It was shown that there was a statistically significant ($p \leq 0.05$) reduction in total weight gain, cholesterol, glucose, triglyceride, ALT and AST in those kittens fed with the added *garlic powder*.

Key words: *rabbits, rabbit kittens, garlic powder, blood biochemical traits*

Introduction

Garlic (*Allium sativum*) is a species of bulbous flowering plant in the genus Allium, which includes onions, shallots and leeks (Rehman, 2003). It is broadly classified into two varieties, namely hard neck (*ophioscordon*) and soft neck (*sativum*) (Borek, 2001). It is one of the oldest known cultivated plants, has been used in medical science and for culinary purposes since ancient times, and is an integral component of the human diet. Egyptians fed garlic to pyramid crews to boost their immunity, thereby rendering them safe from various maladies and improving their performance (Rivlin, 2001). In recent years, studies have been published on the use of natural food additives in animal diets. Many secondary products or plant extracts (e.g. essential oils) have been used in the feed of animals to improve their growth and production (Thakare, 2004; Wallace, 2004). Observations have revealed that the use of such additives has an antibacterial or antifungal effect in the rumen, which improves the utilisation of the diet (Wallace, 2004). As a result, the use of such additives increased after the use of antibiotics as growth promoters in the feed of animals was prohibited. These additives may have a direct influence on some blood traits, including blood glucose levels, as recorded by Raghuvansi, et al. (2007) and Mohammed, et al. (2004) in steers, or manipulate insulin levels, as reported in Holstein cows by Davidson, et al. (2003). Both blood and the biochemical parameters thereof are affected by the addition of foods containing phenols and tannins (Mahgoub, et al., 2008). Garlic and thyme are considered the world's natural foods for heart patients, as well as having antibacterial and antioxidant actions (Sebesan and Caraban, 2008). This study

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was therefore conducted to investigate the effects of both garlic and thyme on the growth and blood biochemical parameters of young rabbits (kittens).

Materials and methods

The study was conducted at the Animal Husbandry Station of the Veterinary Department, Shaqlawa Technical College, Erbil Polytechnic University. Twelve local Iraqi rabbit kittens were selected (4-5 weeks of age) with an average weight of 330±5 grams. Each kitten was housed individually in a cage (1.5 x 2.0m) to ensure they had free access to feed and water. The kittens were fed four control rations per day. The control ration consisted of 18% maize, 40% barley, 30% bran, 10% soybean meal, plus 2% salts and vitamins (see Tables 1,2 and 3). The control ration for groups T2 and T3 were supplemented with 1% and 2% garlic powder (dry weight; g/kg), respectively. The experiment lasted 30 days.

Table 1. Composition of control ration

Feed component	Proportion of ration (in %)
Black Barley*	27
Corn*	15
Wheat*	8
Wheat bran*	32
Soybean*	15
Bentonite**	0.5
NaCl**	0.5
Methionine**	0.3
Lysine**	0.2
Mix vitamins**	1
Caecum carbonite**	0.5

*estimated by nutrition lab of agriculture college
** estimated on the basis of the table of chemical analysis for Iraqi feed stuffs (Fernández-Carmona, et al., 1995)

Table 2. Chemical analysis of control ration (in %)

Dry matter*	88.7
Soluble carbohydrate*	57.74
Ether extract*	2.34
Fibre*	7.45
Ash*	3.94
Crude protein	16.6
Metabolic energy kcal/kg feed**	2791

*NFE (Taha and Farhan,1980)
**metabolic energy calculated on the basis of: 0.0226% crude protein + 0.0407% crude fat + 0.0192% crude fibre + 0.0177% NFE) = 1.94 (Megajol)/kg of matter, which implies 4636 kal/kg of dry matter with garlic according to MAFF (1975).

Table 3. Mineral composition of garlic powder According to Otunola, et al., (2010)

Mineral	Garlic/mg/100g
Sodium	4.10
Calcium	26.30
Iron	5.29
Phosphorous	10.19
Potassium	54.00
Zinc	0.34
Copper	0.001
Manganese	0.001
Magnesium	4.10

The kittens were fed for 30 days to get them used to their diet. Blood samples (10ml/animal), collected from the jugular vein prior to their morning feed, were taken three times at monthly intervals for biochemical analysis. The samples were placed in tubes free of anticoagulant and at room temperature. They were then centrifuged at 3,000 rpm for 15 minutes. Clear non-haemolyzed sera were distributed into Eppendorf tubes and saved at 20°C, as described by Coles (1987). The blood serum samples were examined for albumin, cholesterol, glucose and urea, as recommended by Burtis and Ashwood (1999), triglycerides, as recommended by Sigma (1990), liver enzymes, including ALT and AST, as recommended by Reitman and Frankel (1957), and alkaline phosphates (ALP), as recommended by Henry (1964). The optical density was measured with a spectrophotometer. In accordance with Otto, et al. (2000), globulin was calculated as the difference between the total protein and the albumin. During the last week of the fatting period, and in accordance with Bianospino, et al. (2006), the dry digestion coefficient (Taha and Farhan, 1980) was determined every day for all the kittens by taking samples of their faeces and their feed according to A.O.A.C. (1980). The results were analysed using SPSS (2016), with the mean values compared using a least significant test ($p< 0.05$). The mathematical model was:

$Yij = \mu + Ti + eij$

where, Yij= value of j observation of trial I, μ= overall mean, Ti= effect of theith trial (i=14) and eij= the experimental error associated with observation j.

Results and discussion

Production parameters

The results presented in Table 4 indicate that adding powdered garlic to the control ration, as was the case in the fatted rabbits in groups T2 (1% added garlic powder) and T3 (2% added garlic powder), has a statistically significant effect (P≤ 0.05) on production parameters compared to those fatted rabbits in the control group (T1, no added garlic powder). The feed conversion ratio in the control group (T1) was found to be much higher than in the other two groups, which also went combined with lower total weight gain, transfer efficiency, relative growth rate, and dry matter digestibility. In comparison, no significant differences were observed in the studied parameters between the two groups that received feed with added garlic powder. The reason for the differences between T1 and T2/T3 may be attributed to the fact that garlic increases the speed of bowel movements, which in turn leads to improved digestion (Yamahara, et al., 1990) and absorption. The greater weight of the fattened kittens can be attributed to the enzymes in powdered garlic that help in the digestion of food compounds and increase the metabolic rate (Ademola, et al., 2005). The results are in agreement with those of Onimisi, et al. (2005), who noted a significant increase in the rate of weight gain and equivalent nutritional conversion when adding 2% and 3% garlic powder to feed rations, Ahmed, et al. (2009), when using garlic powder (0.4% and 0.8% per kg) for a period of 49 days, and Ibrahim, et al. (2011), in their experiment on male rabbits for a period of six weeks, and who obtainedZ a significant increase in the rate of weight gain and feed conversion efficiency when they provided 90% of their protein needs +0.75% garlic powder in rations compared to 100% of their protein needs + 0.75% ginger powder, as noted in Table (4). In terms of the amount of feed consumed, statistically significant differences (P≤ 0.05) were found among the three trial groups, with the highest amount of fodder consumed by the control group (T1).

Table 4. Effect of garlic powder on the production parameters of local rabbits

Parameter	Trial groups		
	T1 (control)	T2 1% garlic/kg	T3 2% garlic/kg
Initial weight(g)	330.54±9.71	340.12±8.47	335.98±10.95
Final weight(g)	810.83±31.61^{b}	912.52±38.11^{ab}	919.68±40.71^{a}
Total weight gain (g)	480.29±35.21^{b}	572.4±29.94^{ab}	583.71±24.55^{a}
The total amount of feed consumed(g)/animal	3387.09±182.71^{b}	3085.32±198.51^{ab}	3005.54±219.61^{a}
Feed conversion ratio	7.183±0.01^{b}	5.390±0.20^{ab}	5.149±0.42^{a}
Relative growth rate%*	83.301±9.30^{b}	91.390±11.22^{ab}	92.971±10.45^{a}
Dry matter digestibility coefficient %	67.34±1.05^{b}	68.48±1.22^{ab}	69.86±1.34^{a}
Cost of one kg of spent feed (EU).	0.30	0.31	0.32
The cost of one kg in productive weight gain (EU)	1.79	1.72	1.69

*(According to Ismail, 1988); values are mean ± SE of 4 replicates $^{a\text{-}b}$; test values on the same row with different superscripts for each parameter are significantly different ($p < 0.05$).

Biochemical traits

The results presented in Table (5) show that adding garlic powder to the kittens' feed has a statistically significant effect (P≤ 0.05) on the level of glucose, cholesterol and triglycerides in their blood plasma.

Firstly, there is a statistically significantly (P ≤ 005) reduction in the level of glucose in the blood of the kittens (T2 and T3). The possible reasons for this are that garlic contains hypoglycaemic-lowering phenolic compounds (Day, et al., 1990), or that the inorganic

part of the plant's medicinal elements contains mineral elements (zinc, potassium, calcium, manganese and chromium), which are responsible for the activity of blood sugar and therefore insulin secretion mechanisms (Siddiqui, et al., 2014) in different animals, or that garlic helps the work of insulin because it contains compounds that activate serum insulin secretion (Sekiya, et al., 2004).

Secondly, there is a statistically significantly ($P \leq 005$) reduction in the level of cholesterol in the blood of the kittens (T2 and T3). The reasons for this may be attributed to the ability of garlic to increase the secretion of bile, thereby reducing the absorption of cholesterol into the blood, or the fact that garlic contains a synthesis inhibitor for (E)-^{8} b,17-epoxylabd-liver cholesterol-epoxylabd (Tanabe, et al., 1993). These results are in agreement with Lebda, et al. (2012), who obtained a significant decrease in cholesterol in the serum of New Zealand rabbits fed on a diet supplemented by 2% garlic powder compared with the control group, Al-Qattan, et al. (2007), who obtained a significant decrease in blood sugar levels in male rabbits on the basis of locally dosed (2 mg) boiled garlic extract, and Omage, et al. (2007), who noted a significant decrease in blood cholesterol (30%-40%) levels upon adding 1% and 2% (g/kg) garlic to rabbit feed.

Thirdly, there is a statistically significantly ($P \leq 005$) reduction in the level of triglycerides in the blood of the kittens (T2 and T3). However, there was no significant effect on the percentage of total protein (see Table 5). However, the effects of garlic powder did result in a reduction in the ratio of AST and ALT enzymes, which may either be due to the fact that garlic contains vitamins A, C, phenolic vitamin B, and vitamin B6, which are antioxidants that inhibit the activity of these two enzymes (Kikuzaki, et al., 1994), or because garlic powder contains 5-hydroxyl 3-methoxy phenyl.(Blum 1991), which also inhibit the AST and ALT enzymes. These results are in agreement with Lebda, et al. (2012), who obtained a significant decrease in liver enzymes in male New Zealand rabbits whose feed was supplemented with 2% garlic powder, Dairo and Adanlawo (2007), who pointed out that the use of 100 mg/kg and 500 mg/kg of garlic added to the feed of albino rats decreased the efficacy of the ALT and AST enzymes in their blood serum.

Table 5. Effects of garlic powder on the blood biochemical traits of local rabbits

Attribute	Trial groups		
	T1 (control)	T2 1% garlic/kg	T2 2% garlic/kg
Total protein(g/dl	5.54±0.15	5.58±0.11	5.55±0.13
Triglyceride (mlg/100ml)	35.28±0.30^{a}	30.11±0.23^{b}	28.33±0.10^{c}
Cholesterol (mlg/100ml)	138.03±0.03^{a}	121.985±0.03^{b}	118.053±0.01^{c}
Glucose (mlg/100ml)	105.99±22.43^{a}	82.115±20.11^{b}	77.275±4.56^{ab}
ALT**	27.7±4.02^{a}	25.09±4.91^{b}	25.96±4.23^{b}
AST***	24.82±3.65^{a}	23.01±3.01^{ab}	22.87±4.21^{ab}

Values are mean ± SE of 4 replicates ^{a,b,c}; test values on the same row carrying different superscripts for each parameter are significantly different ($p < 0.05$).

Conclusions

From the results obtained, we can conclude the following: 1) the use of garlic at levels of 1% and 2% (g/kg) of feed leads to an increase in the appetite of rabbits and improves the efficiency of food transfer, resulting in a noticeable increase in live weight; 2) the addition of garlic significantly improved the chemo-vital traits and liver enzyme levels of the kittens; 3) the use of garlic has a positive economic effect in terms of the quantity of feed required, and therefore overall costs, and percentage growth.

In light of the results obtained, we recommend the following: 1) to add garlic at different levels to the feed of local rabbits; 2) to conduct tests on male and female rabbits to determine the effect of garlic on reproductive efficiency and birth rate; 3) to conduct experiments on rabbits using a mixture of garlic and antioxidant compounds such as ginger and conduct biochemical tests accordingly; 4) to try using higher levels of garlic in a rabbit's diet to see if it has a positive or negative effect.

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