The effect of garlic solution supplementation on performance, carcass weight and abdominal fat of broiler chickens

M Taufik1 dan F Maruddin2

1Agriculture Extension College of Gowa, Jl. Poros Malino Km. 7 Romang Lompoa, Gowa, South Sulawesi, Indonesia
2Faculty of Animal Science, Hasanuddin University, Jln. Perintis Kerdekaan Km. 10, Tamalanrea, Makassar, South Sulawesi, Indonesia.

Email : taufikpat70@gmail.com

Abstract. Garlic has been well known as one of the medicinal plants. In addition, active compounds in the garlic may also induce performance of chicken. This research aimed to investigate the effect of garlic supplementation in drinking water on the performance of broiler chickens, carcass weight, and quantity of abdominal fat weight. Completely randomized design (CRD) was arranged. One-day old broiler chickens Lohmann MB 202 with initial weight of ±40 g (unsexed, 100 birds), were randomly introduced to the following treatments: (P0) water + 0% carcass; (P1) water + 3% carcass; (P2) water + 6% carcass and (P3) water + 9% carcass. Each treatment was carried out at 5 replications, using at least 5 chickens for each replication. Garlic was supplemented in water for chickens, from one-day old to the end of experimental period (35 days). Based on the experimental results, it can be concluded that the giving of garlic solution does not have an effect on the overall performance of the broiler, carcass weight, and abdominal fat, but based on the average value of performance, carcass weight and abdominal fat it can be concluded that treatment P0 gives better than other treatments (P1, P2 and P3).

1. Introduction

In Indonesia, herbal plants have been long used as traditional medicine and treatments of disease prevention in human. However, the use of herbal plants for animal husbandry sector is rather scarce. Some of the plants included Aloe vera, Bancudus latifolia, and black cumin. Garlic (Allium sativum) is one of the herbal plants widely used as spices and medicines. Allicin, ajoene, and flavonoid compounds are considered as the major bioactive compounds in garlic; thus, it is superior as source of antioxidant [1, 2]. Maryam et al [3] reported that the addition of garlic at level of 4% in chicken feed containing low content of aflatoxin (0.4 mg AFB/kg) demonstrated the increment of productivity and egg production.

The active compounds in garlic are hypothesized capable of substituting the role of synthetically-made antibiotics commonly applied in chicken. Therefore, this indicates that the use of garlic may reduce undesired effects of antibiotics, improve the health status of the animals and contribute to the increasing of food safety.

Broiler’s feed supplemented with garlic flour was found to improve growth of the chickens and enhance of digestive system, thereby optimizing the nutritional absorption from feed. The treatment was also meaningful in order to maintain immune system of the animals. Therefore, the addition of...
garlic in broiler’s feed was expected to cause desirable impacts to the growth performance and carcass quality while also considering the food safety for consumers.

2. Methods

2.1. Materials
Broiler chicken was from strain Lohmann MB 202, while the main materials included commercial feed (crumble), garlic, and water. The supporting equipment included balance, water, and container for garlic.

2.2. Experimental design
Research design was conducted according to completely randomized design. A total of 100 broiler chickens Lohmann MB 202 (one day old chicks, unsexed, average initial weight of ±40 g) were distributed into 4 groups based on following treatments: Water + 0% garlic (P0), Water + 3% garlic (P1), Water + 6% garlic (P2), and Water + 9% garlic (P3).

Each treatment was repeated 5 times, totally resulting in 20 experimental units consisting of 5 chickens per unit. The treatment was given to one day chicks until 35 days of experiment. Water was provided ad libitum.

2.3. Experimental methods
The cage was constructed according to following dimension: length 60 cm, width 60 cm, and height 50 cm. Cages were distributed in a row and randomly selected for each cage per experimental unit. The chicken cage was equipped with feed and water tank, each fitted with 60-watt lamp bulb, 40 cm above the floor, which is used as heat source (for chicks of 1-14 days). Starting from 15th day to 35th day. The 24-h lighting period was carried out during the trial period.

Chickens were reared for 35 days and fed twice a day (ad libitum) with commercial crumble feed as starter (from 1st day to 14th day) and pellet as finisher (from 15th to 28th day). Chemical composition of both feeds was presented in Table 1. Feed and water consumption were daily observed, while weight of chickens was observed once a week.

During experimental period, supplementation with multivitamin was carried out at period of 1st – 5th days, while commercial antibiotic and vaccination were not given.

Table 1. Chemical composition of starter (age of 1-14 days) and finisher feed (age of 15-35 days)

| Chemical composition | Type of feed |
|----------------------|--------------|
|                      | Starter*     | Finisher**   |
| Crude protein (%)    | 22-23        | 20-21        |
| Crude fat (%)        | 6%           | 7%           |
| Crude fiber (%)      | 3-4%         | 3-4%         |
| BETN (%)             | 50           | 51           |
| Ash (%)              | 5,5          | 5,5          |
| Ca (%)               | 1,5          | 1,5          |
| P (%)                | 0,5-0,7      | 0,5-0,7      |

Note: mark * means that the value was given by producers/suppliers, while mark ** indicates that value was obtained by calculation.
2.4. Parameters

2.4.1. Feed consumption. Referred to the total feed consumed by chickens. Initial weight of feed was known, and remaining feed was daily calculated at the end of the day. The difference was expressed as feed consumption.

2.4.2. Final body weight (g/bird) was determined by weighing the chicken in the end of trial at 35th day.

2.4.3. Feed conversion was expressed as the ratio between feed consumption (g/bird) and final weight (g/bird).

2.4.4. Carcass weight, Quantity of carcass, was determined by weighing the final weight of chickens (1 bird per cage). They were slaughtered exactly at vena jugularis and left to allow blood release, in which the legs were set at the top while chicken’s bird was set at the bottom. The slaughtered chickens were then soaked in hot water (52-55 °C) for 45 sec (semiscalding), enabling to remove feather easily [4]. After all feathers were removed, chickens were then eviscerated while head and legs were cut.

2.4.5. Abdominal fat weight, which lays between abdominal muscles and the intestines) was collected by separating it from carcass, then weighed.

2.5. Statistical analysis

Data collected were statistically evaluated using analysis of variance according to Completely Randomized Design. Their significant variance was compared using Least Significant Difference test [5].

3. Results and discussion

The studied parameters, i.e. performance, percentage of carcass and abdominal fat, are presented in table 2.

Table 2. Average performance, carcass weight and abdominal fat of broiler chickens treated with garlic.

| Parameters          | Treatments |
|---------------------|------------|
|                     | P0         | P1         | P2         | P3         |
| Feed consumption (g/bird) | 1753.95<sup>a</sup> | 1897.68<sup>a</sup> | 1875.77<sup>b</sup> | 2045.79<sup>a</sup> |
| Final weight (g)    | 1270.39    | 1227.66    | 1145.03    | 1375.02    |
| FCR                 | 1.38       | 1.54       | 1.63       | 1.49       |
| Carcass weight (g)  | 940<sup>a</sup> | 1000<sup>a</sup> | 840<sup>a</sup> | 1000<sup>a</sup> |
| Abdominal fat (g)   | 22.07      | 23.61      | 20.59      | 25.05      |

Note: similar superscripts in the different column indicated insignificant difference (P>0.05)

3.1. Feed consumption

Feed consumption reflects the amount of consumed feed by a broiler chick for a particular period. Wahju [6] described that feed consumption could simply be determined by a difference between feed given and consumed feed. The application of ad libitum feeding allowed the chickens to have free access to the feed. Rasyaf [7] also described that feed contained a lot of important nutrients from several feed components required for nutritional requirement of the animals.

As described in Table 2, average feed consumption of P0 was the lowest, i.e. 1.753.95 g/bird, which was much lower than P1 (1.897.68 g/bird), P2 (1.875.77 g/bird) and P3 (2.045.79 g/bird). Statistical analysis demonstrated that the use of garlic solution significantly affected feed consumption.
(P<0.05). However, based on LSD test, all treatments (P1-P3) did not show any significant difference (P>0.05), which may be due to the slight level of garlic concentration. This is also in accordance with report of [8], finding that presence of garlic at dose of 0.25% did not alter feed consumption of broiler chickens. This indicates that addition of garlic at level of 0.25% could still be tolerable by the chickens. The changes in palatability primarily odor and taste of diet due to garlic are not influential for feed consumption of broiler chicken. Previously, another research [9] also found that the supplementation of garlic up to 5% did not cause significant impact to feed consumption of Peking duck.

3.2. Final weight
Average final weight of broiler chickens showed that the highest score was attributed to P3 (1375.02 g), and followed by P0 (1270.39 g), P1 (1227.66) and P2 (1145.03), respectively. Statistically, supplementation of garlic showed no significant effect on final weight of broiler chicken (P>0.05). This is ascribed to the similar composition of feed, particularly energy and protein, thereby resulting in similar final weight. Similarly, another report of [10] found that diet supplemented with garlic up to 0.6% did not significantly affect final weight of broiler chickens.

3.3. Feed conversion
The results showed that feed conversion ratio was described as follows: P0 (1.38) < P3 (1.49) < P1 (1.54) < P2 (1.63). In this case, the feed conversion was desirable. Statistical approach demonstrated that supplementation of garlic did not affect feed conversion (P>0.05). This is in line with result of [11] finding that addition of garlic powder at dose of 0.5%, 1% and 3% in broiler’s diet from DOC to finisher did not affect feed conversion. This may be due to the dissimilarity in feed consumption and final weight for each treatment. [12] found that feed conversion was influenced by several factors, i.e. feed quality, chicken’s strain, and feeding treatments. This is also augmented by [13] reporting that, besides feed quality, feeding method can noticeably affect feed conversion. Furthermore, proper feeding treatment could suppress feed conversion, enabling to enhance financial benefits. [7] asserted that lower feed conversion was more desirable, which indicates high feed efficiency.

3.4. Carcass weight
As presented in Table 3, carcass weight of broiler chicken was recorded as follows: P3 (1000 g), P1 (1000 g), P0 (940 g) and P2 (840 g). However, statistical analysis showed that the treatments did not significantly affect carcass quantity (P>0.05). Similarly, other studies (Sarica et al., 2005; [14]) reported the addition of garlic powder at level of 0.1%, 0.2%, and 0.4% in feed. As a result, the treatments showed no significant effect on carcass weight. In addition, [15] incorporated garlic powder of 500 and 5000 mg/kg in feed, and found that the treatments did give significant effect on carcass weight of broiler chickens. This can be explained that garlic quality (type, preparation method, dose, feeding interval) may also provide noticeable roles on determining quantity of carcass. [16] reported that content of bioactive compounds in herb plants might also vary, depending on geographical condition, climate, storage condition, and maturity.

3.5. Abdominal fat
As presented in Table 2, average weight of abdominal fat is described as follows: P3 (25.05 g) > P1 (23.61 g) > P0 (22.07 g) and P2 (20.59 g). The lower quantity of abdominal fat was associated with the capability of garlic to reduce the fat abundance in broiler chickens. Fat in chicken’s tissue enables to increase live weight, and fat accumulation seems to be remarkably increased in the end of period, since at this time, the movement of broiler chickens is drastically reduced. Therefore, the supplementation with garlic is expected to lower broiler’s abdominal fat, and high content of protein in feed could be also useful to suppress fat accumulation, while also considering energy balance in feed [7].
Analysis of variance demonstrated that the treatments did not significantly affect the abdominal fat quantity (P<0.05). This is also in line with that reported [17] investigating the supplementation of garlic in the fattening feed towards carcass quality of broilers. The results showed that carcass quality of chickens fed with diet containing 2% of garlic was not different compared to control group. Pourali [16] investigated the effects of garlic supplementation on performance and immune response of broiler chickens. Their experiments concluded that garlic supplementation at 0%, 0.2%, 0.4%, 0.6%, 0.8%, and 1% did not produce significant difference on carcass quality (P<0.05), primarily on abdominal fat. However, there is a tendency that abdominal fat is reduced with the increase in garlic dose. This was in agreement with that reported [15], studying the response of broiler chickens (performance and meat quality) after treated with diet containing garlic. The results showed that garlic supplementation in feed did not significantly affect percentage of abdominal fat (P>0.05), even though it seemed to be decreased.

4. Conclusion
Based on experimental results, Based on the results, it can be concluded that the giving of garlic solution does not have an effect on the overall performance of the broiler, carcass weight, and abdominal fat, but based on the average value of performance, carcass weight and abdominal fat it can be concluded that treatment P0 gives better than other treatments (P1, P2 and P3).
References
[1] Santosa H B 1991 Bawang putih (Jakarta; Kanisius)
[2] Kim MY, Choi SW and Chung SK 2002 Antioxidative flavonoids from the garlic (Allium sativum L.) shoot Food Sci. and Biotechno. 9 99-203
[3] Maryam R, Sani Y, Juariah S, Firmansyah R dan Miharja 2003 Efektivitas ekstrak Bawang Putih (Allium Sativum Linn) dalam penanggulangan aflatoksikosis pada ayam petelur J. Ilm.Ter. dan Vet. 8 239 - 46
[4] Murtidjo BA 2003 Pedoman Beternak Ayam Broiler (Jakarta; Kanisius)
[5] GasperszV 1991 Metode Perancangan Percobaan (Bandung: CV.Armico)
[6] Wahju J 1997 Ilmu Nutrisi Unggas vol 4 (Yogyakarta: Gadjah Mada University Press)
[7] Rasyaf M 1999 Menajemen Beternak Ayam Broiler (Jakarta: Penebar Swadaya)
[8] Dharmawati S Firahmi N dan Parwanto 2013 Penambahan tepung bawang putih (Allium Sativum L) sebagai feed additif dalam ransum terhadap penampilan ayam pedaging Majalah Ilmiah Pertanian Ziraa’ah 38 17-22
[9] Saleh E Hestiwyahuni T dan Saragih G 2006 Pemberian tepung bawang putih (Allium sativum L.) dalam ransum terhadap performas itik peking umur 1–8 minggu J. Agr. Peter. 2 96-100
[10] Fadlala IMT, Mohammed B H and Bakhiet A O 2010 Effect of feeding garlic on performance and immunity of broilers Asian J. Poult. Sci. 4 182-89
[11] Raaesi M, Hoseini-Aliabad SA, Roochae A, Shahneh AZ and Pirali S 2010 Effect of periodically use of garlic (Allium sativum) powder on performance and carcass characteristics in broiler chickens World Acad. Sci. Eng. Technol. 68 1213-19
[12] Sapsuha Y 2006 Pengaruh tingkat penggunaan feces puyuh dengan teknologi effective microorganism dalam ransum broiler terhadap pertambahan berat dan konversi ransum. J. II. Perta. Cannarium 4 57-65
[13] Amrullah IK 2003 Nutrisi Broiler Seri Beternak Mandiri (Bogor: Lembaga Satu Gunung Budi)
[14] Sarica, S., Ciftei, A., Demir, E., Kilinc, K. and Yildirim, Y. 2005. Use of antibiotic growth promoter and two herbal natural feed additives with and without exogenous enzymes in wheat based broiler diets. S. Afr. Anim. Sci. 35:61-72
[15] Issa K J and Omar JMA 2012 Effect of garlic powder on performance and lipid profile of broilers J. of Ani. Sci. 2 62-8
[16] Onibi G E, Adebiyi O E, Fajemisin A N and Adetunji A V 2009 Response of broiler chickens in terms of performance and meat quality to garlic (Allium sativum) supplementation Afr. J. Agric. Res. 4: 511-7
[17] Pourali M, Mirghelenj SA and Kermanshahi H 2010 Effects of garlic powder on productive performance and immune response of broiler chickens challenged with Newcastle Disease Virus Global Vet. 4 616-21.
[18] Stanacev V, Milosevic N, Plavska N, Bjedov S, Puvaca and Arapovic Z 2010. Phyto additives (Allium sativum L) in the diet of fattening chickens Proc. of XIV Inter. Symp. Feed Techn. 19th – 21st October 2010 Institute for Food Tchnology, University of Novi Sad p 295-301