EFFECT OF ONION AND / OR GARLIC AS FEED ADDITIVES ON GROWTH PERFORMANCE AND IMMUNITY IN BROILER MUSCOVY DUCKS.

Ibrahiem A. Ibrahiem, Talib A. Elam, Fathi F. Mohamed, Sabry A. Awadalla, Yousif I. Yousif

1El-Wafaa Farm, El-Haram, Gizza, Egypt.
2Regional Animal Health and Production Expert, FAO, RNE, Cairo.

ABSTRACT

Thirteen thousands, one-day old Muscovy ducklings, were randomly divided into 13 equal groups and raised on a starter ration (19.4 % crude protein and 2900 k cal / kg) to which onion and/or garlic were added at different rates to all groups except the control group. After the first 7 weeks of life the birds were raised on a finisher diet (17% crude protein and 3000 k cal/kg) and treated as the aforementioned treatment for another 5 weeks. Some economical parameters were calculated. There were a significant increase in life body weight and life body weight gain and feed conversion rate (FCR) in groups which fed rations supplemented with 3 % garlic and 3 % garlic with 1% onion, respectively. An interesting result was observed that at the end of the 10th week, FCR was significantly better than that at the end of the 12th week (3 versus 3.67); performance index was 113.7 versus 104 and maximum net revenue/duck per LE was 8.2 versus 7.8 in the group received 3 % garlic. Therefore, it is more economic to treat ducks with ration supplemented with 3 % garlic and slaughter them at the end of the 10th weeks. The weight of bursa of Fabricious and spleen in males and females were about 2-3 times more than the control, a result which points to the improvement of the immune system of birds which were fed on these feed additives. A reduction in the weight of livers in all treated groups by 2-3 times indicates a diminution of fat deposition in this vital organ. The small intestine length was slightly increased (5-18 %) whereas there was a 2-3 % reduction in small intestine thickness in all treated groups which indicates good absorption and utilization of nutrients.
INTRODUCTION

Onion (Allium cepa L) and garlic (Allium sativum L.) are cultivated widely in Egypt and used as flavoring agents, a common feed and popular remedy. Because of the hypoglycemic effect of onion and due to its insulin like activity and the thyroid like activity of garlic, it is suggested that they have a growth stimulating effect (12, 18), moreover onion and garlic have a beneficial effect on lowering the level of cholesterol in blood plasma and serum of animals (1). Onion and garlic were used by Egyptian farmers since long time ago in poultry diets because they believed that, both onion and garlic have protective effect against disease in addition to some valuable nutrients such as vitamins, minerals, essential amino acids and essential fatty acids (12, 14, 17). Garlic formed part of the daily diets of many ancient Egyptians, particularly the working class involved in heavy labor, as in building of the pyramids (21) as garlic cloves were found in the tomb of king Tutankhamen.

Although raw garlic causes anemia, weight loss and growth failure in rats (25), aged garlic extract was reported to have antistress effect (27), improves peripheral circulation (21) protects vascular endothelial cells from oxidant injury and reduces plasma lipids (27). Natural foods are generally believed to be safer, more healthy and less subject to hazards than foods containing artificial additives. Both onion and garlic used as natural growth promoters as phytogenic feed additive alternative to chemical growth promoters. McCartney (19) summarized the mode of action of fresh onion and/or garlic active principles as follows: Onion and garlic stimulate blood circulation, improve immune response and antibacterial effects due to its contents of pungent substances. Also, the pungent substances in onion or garlic lead to higher production of saliva and gastric juices. The secretion of the salivary glands and gastric juices is stimulated by vagal nerve feed back. And due to bitter substances in stomach, the gastric phase will be initiated gastrin which has stimulate the secretions as well as on the motility of the stomach and small intestine also increases the production of pancreatic juices (8). Onion and garlic stimulated growth by increasing the inflow of glucose into tissues, thyroid like activity (12).
The objective of this work was to investigate the effects of feeding fresh onion and/or garlic as dietary supplements in broiler Muscovy ducks on growth performance, and immunity.

MATERIAL AND METHODS
Diets were formulated to cover breed requirements of Muscovy ducks (starter and finisher) as indicated in tables 1 and 2.

Preparation of Garlic and/or Onion:
The stalk of fresh garlic were cut off and whole fresh onion were minced by an electrical mixer. Some modification had been done in the shopper (The number of knives was increased from 4 to 6 which were made from stainless steel in addition to very fine sieving holes 8 mm) then mixed with other feed constituents of diet.

Birds management:
All experimental ducks were housed in floor pens with wood shaving litter. Floor pens were washed and disinfected prior to the beginning of the experiment.

Electrical heaters were used to maintain room temperature at 35°C through the first week of age then temperature decreased gradually to 27°C during fourth week of age. Artificial lighting was provided constantly throughout experimental period.

Water and mash feed were provided ad lib throughout the experimental period and all experimental ducks were vaccinated against duck plague at 10th day old.

Measurements
Average live body weight (LBW):
Live body weights of ducklings and actual feed intake were recorded weekly during the 2 week experimental period.

Lymphoid organs weight index:
Was calculated for bursa and spleen according to the method described by Montgomery et al. (20) as follows: \[
\text{Organ weight} \times 100 \div \text{body weight}
\]

Feed conversion =
Average feed consumed in gram per interval

\[
F.C. = \frac{\text{Average body weight gain in gram in the same interval}}{\text{Average body weight gain in gram in the same interval}}
\]

Mortality rate was calculated at the end of the experimental period.

Small intestine length and thickness was calculated according to Statuz et al. (26) as follows:

1) small intestine fresh weight in g. / Small intestine length in cm \times 100
2) small intestine dry weight in g. / Small intestine length in cm \times 100

Liver weight/bird/g.

Was recorded in grams and as percentage of final body weight.

Small intestine length:
Small intestine length and weight were determined by the procedure described by Statuz et al. (26).

The economical efficiency was calculated from the input-output analysis based upon the differences in both growth rate and feeding cost. The values of economical efficiency were calculated as the net revenue per unit of total cost.

\[
\text{EE} = \frac{\text{Net revenue/ chick (LE)}}{\text{Total cost / chick (LE)}}
\]

Performance index = \((\text{live weight / feed conversion}) \times 100\) (22).

The obtained data were statistically analyzed according to Petrie and Watson (24).

**RESULTS AND DISCUSSION**

This study aimed to throw light on the effect of incorporation of various levels of fresh onion and/or garlic to diets of Muscovy ducklings reared from 0–12th week on productive performance carcass characteristics, bursa, spleen, liver weight, small intestine length and thickness, and economical efficiency.

The live body weight gain was increased by the addition of fresh onion and/or garlic at different inclusion rate. The obtained results and recorded observation clearly focused in group received ration supplemented with 3% garlic and 1% onion plus 3% garlic. Similar finding were reported by El Afify (9) who found that live body weight and live body weight gain were significantly improved in broilers chickens when fed diet containing onion or garlic extract or garlic residue.
In broilers, Bidura (5) who demonstrated a significant increase (P<0.05) in all performance of growing duck aged 0 – 8 weeks live body weight, live body weight gain, feed consumption and feed conversion when diet containing 0%, 3% and 6% garlic leaf meal compared to control one.

El Nawawy (12) who reported that body weight gain of boiler chickens were improved when adding 1% fresh onion or garlic to their rations, also El Nahla (11) who stated that adding 2% dry onion or garlic into broilers improved their live body weight gain.

The above results may be explained due to their contents of sulphur components that are considered as active antimicrobial agents.

Feed consumption:

One can easily observe a decrease in feed consumption in all supplemented groups and specially in groups received diet supplemented with 3% garlic or 1% onion + 3% garlic (5.2% - 4.6%) respectively. This result agrees partially with that obtained by El-Habbak et al (10) who reported a significant decrease in feed consumption at the 3rd week of age when Japanese quail were fed garlic cloves in diet.

On the other hand, Alm EI-Dien (3) found that Isa-Brown and Fayoumi hens fed garlic in diets their consumed significantly more feed than control. Feed consumption was significantly more when hens fed garlic for 6 than for 3 days/week in diet. This effect was disappeared directly after feeding the basal diet.

Horton et al., (15) found no obvious effect in feed consumption, when broilers fed powder garlic at the level of 0.1, 1.0 or 10.0 g/kg diet during 1-35 days of age.

Our results also, disagree with that obtained by EL Afify,(9) who obtained increase in feed consumption when broiler fed garlic or garlic residue supplemented ration and El Nahla (11) who found that broiler chicken fed garlic supplement diet consume more feed than the control free one after 6th weeks of age. Also El_Nawawy (12) reported that feed consumption of broiler chickens fed garlic diet was higher by about 6% than the control.

It can be concluded that the largest reduction of feed consumption in broiler ducks were observed when received 3% garlic (5.2%) and 1% onion + 3% garlic (4.6%) but cumulative feed consumption at week 0-10th lower than the same at 0-12th week.

Feed conversion:
The observed results showing that supplementation of different levels of fresh onion and/or garlic to diets of broiler muscovy duck (0–12th week) improve the feed conversion ratio. Group fed supplemented diet with 3% garlic or 1% onion + 3% garlic showed the better feed conversion ratio (2.99 or 3.05) at 10th week and more economically while it was (3.67 or 3.74) at 12th week respectively. Improvement in feed conversion rate attributed to the reduction of small intestine thickness since the nutrient absorption is more efficient through thinner intestinal wall that reflected on the improvement of absorption which translated to improvement in feed conversion.

However El Afify (9) who found slight insignificant improvement in feed conversion ratios associated with adding garlic or its fractions into chicks diets, the value of feed conversion ratio for entire experiments periods (0–5 week) were 1.83, 1.88, 1.86, 1.89 and 1.91 respectively for minced garlic, garlic juice, garlic residue, garlic oil and control group. These results are in agreement with Dafwang et al., (7) who demonstrated improvement in feed conversion ratio of chicks due to decrease in small intestine thickness resulted from feeding dietary antibiotics. Bidura (5) found that there is increase significantly (P≤0.05) in feed conversion ratio with increasing levels of garlic leaf meal in growing duck diet aged 0–8 weeks. While El Nawawy (12) found that feed conversion was nearly identical when compared Hubbard broiler chicken control with those fed garlic, onion or garlic plus onion. Abdo (2) observed better feed conversion by using garlic in broiler diet, feed conversion was 1.61, 1.79 and 1.81 for 6, 3 and 0% garlic groups respectively.

So, the better performances were obtained when ducks were fed a diet supplemented with 3% garlic or 1% onion + 3% garlic, as both of them consumed less feed and achieved high final live body weight than other groups.

Effect of feeding fresh onion and/or garlic on Immune response

Spleen weight in grams of male and female broiler Muscovy ducks are shown in table 4. Spleen weight was increased in all fresh onion and/or garlic supplemented diet groups compared to control one. The increase in spleen weight were ranged between 25 – 30% in both group supplemented with 3% garlic and 1% onion + 3% garlic.
Bursa weights in grams in table (4) of broiler Muscovy ducks were increased in all fresh onion and/or garlic supplemented diet groups than control one.

Bursa weight follow the same phenomena of spleen. These results were in agreement with those obtained by EL Afify (9) who reported that bursa and spleen weights were magnified by feeding garlic and/or its fractions to broiler chicks. As percentage to control this magnitude in bursa weight were 74%, 31%, 42% and 74% while spleen weight were 53%, 10%, 18% and 63% by feeding minced garlic, garlic juice, garlic residue and garlic oil respectively. Moreover Abdo (2) demonstrated an increase in spleen weight when supplementing with 3% garlic in broiler chicks rations. Birds with bigger bursa had better disease resistance and higher efficiency for immune globulin synthesis. (16, 28)

Onion and/or garlic have a mode of action similar to antibiotics. So, the increase in bursa weight resulting of increased blood protein also, slight increase in blood globulins and globulins to albumins ratio when feeding onion and/or garlic to broiler chicks. This increase in blood globulins is probably related to high activity of large bursa which is primary site for synthesis of immunoglobulin gamma (7)

Liver weight of male broiler ducks was reduced by feeding rations supplemented with onion and/or garlic to broiler Muscovy ducks and the reductions were ranged between 105-120 g. in group fed ration supplemented with 1% onion + 3% garlic and the control ration group respectively.

Liver weight of female broiler ducks was reduced by feeding onion and/or garlic supplemented ration to broiler Muscovy ducks and ranged between 53 - 62 g. in group fed diet supplemented with 1% onion + 3% garlic and the control diet group respectively. These results agreed with those obtained by Augusti and Mathew (3) and Chi et al. (6) and EL Afify, (9) who showed that liver weight of broiler were decreased by feeding onion and/or garlic supplemented rations with 11%, 6%, 8% and 11% for groups of chicks fed fresh garlic, fresh onion, dry garlic and dry onion respectively. This may be due to inhibition of fatty acids synthesis and other lipid components in liver and reduce the level of fat accumulation in liver, which leads to a decrease in liver weight.
Data presented in table (5) illustrated small intestine length, weight and thickness for broiler Muscovy duck at the end of experiments. A reduction in small intestine fresh and dry weight was observed by feeding different levels of fresh onion and/or garlic supplemented rations and ranged between 98 - 115 g. for fresh weight and ranged between 59 - 65 g. for dry weight of males duck. The reduction ranged between 54 – 64 g. for fresh weight and 34-42 g. for dry weight in females duck.

A slight increase in the length of small intestine was observed for all onion and/or garlic supplemented groups as compared to control and ranged between 0 – 4.6% for males and ranged between 0 -7.4% in females. Small intestine thickness fresh weight as percentage to control group were ranged between 83.9–88.9% in males while ranged between 69 – 89.8% in females. At the same time, small intestine thickness dry weight as percentage to control group was ranged between 89.6 – 94.9% in males and between 77 – 97% in females.

It can be concluded that small intestine thickness was shorter than control by 10.4% in male groups fed diet supplement with 3% garlic or 1% onion + 3% garlic while the reduction in small intestine thickness was 20% - 23% than control group in females fed supplemented diet with 3% garlic or 1% onion + 3% garlic respectively. Shashikanth et al. (25) reported that there was stomach injury due to irritant action of garlic on epithelial tissue of the inner wall of small intestine so, reduction in small intestine is probably attributed to antimicrobial activity of onion and garlic against gut microflora which is responsible for thickness increase of small intestine.

The obtained results agreed with those of EL Afify (9) who found that feeding onion or garlic to broiler chick decreased small intestine thickness (fresh and dry weight) by 13%, 17%, 16% and 14% for groups fed fresh garlic, fresh onion, dry garlic and dry onion respectively as compared with control. The reduction in small intestine thickness can be considered as a good guide for antimicrobial property of onion and garlic since this reduction reflects the action of onion and garlic against gut microflora which produce toxins or metabolic products that are responsible for irritation and increase the thickness of small intestine. On other hand the reduction in small intestine thickness of broiler Muscovy duck in our experiment may be due to proper preparation of onion and/or garlic before mixing ration to ensure thoroughly mixing of fresh onion and/or garlic.

Ibrahim A.I., et al., 2004
The Performance index and Economical efficiency:

Tables (6) and (7) showed the economical efficiency of feeding different levels of fresh onion and/or garlic to broiler Muscovy duck after 12th week experimental period. The highest economical efficiency values were obtained in groups fed diet supplemented with 3% garlic and 1% onion + 3% garlic 0.419 and 0.378 respectively while control one was 0.123.

The maximum net revenue/duck was for the diet supplemented with 3% garlic (7.87 LE) and 1% onion + 3% garlic were (7.18 LE). While the lowest net revenue/duck value was for control free diet (2.31 L.E) and the supplemented ration with 1% onion + 4% garlic (2.80 LE). On other hand the performance index % indicated that the best value was recorded in 3% garlic ration which represent (104.9%) followed by 1% onion + 3% garlic (101.6 %) supplemented ration respectively.

The highest economical efficiency values were obtained in groups fed diet supplemented with 3% garlic and 1% onion + 3% garlic (0.536) and (0.500) respectively while control one was (0.269).

The maximum net revenue/duck was for the diet supplemented with 3% garlic (8.21 LE) and 1% onion + 3% garlic were (7.81 LE). While the lowest net revenue/duck value was for control free diet (4.17 L.E) and the supplemented ration with 1% onion + 4% garlic (4.72 LE). On other hand the performance index values indicated that the best one was recorded in 3% garlic ration group which represent (113.7%) followed by 1% onion + 3% garlic (111.47 %) supplemented ration respectively.

Finally the economic study showed that the groups fed supplemented rations with 3% garlic or 1% onion + 3% garlic supplemented ration, could be recommended from day old broiler Muscovy duck till 10th week than 12th week of age. As they gave the maximum net revenue / ducks and more economical.

These result is coincided with the result obtained by Abdo (2) who obtained that performance index, maximum net revenue and economical efficiency value in 3% garlic was better than 6% garlic supplemented ration in broiler chicks.
REFERENCES


تأثير إضافات البصل والثوم للعليقة على الأداء والمناعة في بداري البط المسكوفي

إبراهيم أحمد إبراهيم، طالب علي إيلام، صبري أحمد عوض الله، يوسف إبراهيم، محمد فاروق، إيلان، محمد فاروق محمد، صبري أحمد عوض الله، يوسف إبراهيم، إيلان
مزرعة الوقاية المهرام- جيزة، منظمة الأغذية والزراعة- القاهرة، قسم التغذية كلينية الطب البيطري، جامعة القاهرة، قسم أمراض الدواجن، كلينية الطب البيطري- جامعة القاهرة، مزرعة الوفاء الهرم- جيزة، منظمة الأغذية والزراعة- القاهرة

تم تقسيم ثلاثة عشر ألف طائر من البط المسكوفي عند عمر يوم عشانًا إلى 13 مجموعة متساوية تم تغذية البط على عليقة باهية 1.94% بروتين و2.22 كيلوجرام عاطمة لكل كجم عليقة) أضيف لهذه العلائق البصل والثوم بنسب مختلفة لجميع المجموعات ماعدا المجموعة الضابطة. بعد مرور 9 أسابيع جميع الطيور تغذت على عليقة ااهييىة 17% بروتين و3222 كيلوجرام عاطمة لكل كجم عليقة (كجم عليقة) وعولمت بنفس إضافات البصل والثوم لمدة 5 أسابيع أخرى.

وجد زيادة معنوية في وزن الطيور الحية وكذلك في زيادة في الوزن الحي للطيور ومعىد التحويل الغذائي في المجموعات التي تغذت على علائىق مضيال إليهىا اسىب 3% ثىوم و 1% بصل + 3% ثئوم على التوالي.

وبهذا اللافت للنظر أنه شهد عند الأسبوع العاشر تخسيس معنوي في معدل التحويل الغذائي عند نهاية الأسبوع الثاني عشر (3 مقابل 3.67) ومعدل الأداء كان 113.7 مقابل 104 وكذلك كان 8.2 مقابل 7.2 في المجموعة التي تغذت على 3% ثئوم.

وإلا عليه في معدة الطيور كانت هناك زيادة معنوية في وزن كيس وافريسي والطحال في كوك وانث البط بحوالي 2-3 ضعف المجموعة الضابطة، وهذه النتائج تحسن التحفيز في الجهاز المناعي للطيور في الوزن المكسيكية على هذه الإضافات وأيضا لوحظ نقص في وزن الكبد عن المجموعة الضابطة مما يعكس نقص في ترسيب الدهون في هذا العضو الحيوي الهام، وكذلك لوحظ زيادة في طول الأمعاء الدقيقة بحوالي 5-18% وأيضا نقص في سكينها مما يعكس انتصاد جيد واستهلاك أفضل للغذاء المهم.