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# Effect of dietary Supplementation of Garlic Along with Multi-strain Probiotic on Growth Performance, Nutrient Digestibility, Anti-oxidant Profile, Carcass Profile and Economy of production of Broiler Bird

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**A B S T R A C T**

By the end of this decade, globally, poultry meat is expected to represent 41 per cent of all the protein from meat sources. Poultry meat consumption is expected to rise as consumers are attracted not only due to lower prices but also product consistency and adaptability as well as higher protein / lower fat content. After the ban of application of sub-therapeutic levels of antibiotics, development and application of non-antibiotic alternatives like probiotics as performance enhancers are increasing. Although, there is limited research about the effect of these prebiotic and probiotics on broiler performance. One hundred eighty no. (N=180) of day old commercial Ven Cobb 50 broiler chicks were randomly distributed into 4 treatment groups *i.e.*, $T_0$, $T_1$, $T_2$ and $T_3$, where $T_0$ fed with basal diet and treatment groups were fed with (0.25%,0.50% & 0.75%) garlic powder add mixture with probiotics culture(1-2 × $10^9$).In the current investigation various beneficial effects of synbiotics have shown but among all the treatments 0.50% garlic powder along with multi-strain probiotics can enhance growth performance, digestibility, antioxidant profile and economy of herd can be obtained.

## Introduction

Feed additives are generally used to improve feed intake and increase growth rate in broilers (Abouelfetouh *et al.*, 2012).Probiotics are defined as "live microorganisms which when administered in adequate amount confer health benefits to the host" (FAO/WHO, 2002). Probiotics enhance immunity, health and growth in all ages and class of poultry, improving a healthy balance of bacteria in the gastrointestinal tract, promoting the gut integrity and maturation, boosting the immune response and preventing inflammation, improve feed intake and digestion by increasing the activity of digestive enzyme and decreasing activity of bacterial enzyme as well as decreasing ammonia production,

neutralize enterotoxins and stimulate immune function (Kabir, 2009; Alagawany *et al.,* 2016; Soomro *et al.,* 2019). Probiotics modulate intestinal microbiota and reduce the pathogen, improve the immunity sensory properties of broiler meat (Pelicano *et al.,* 2005), and promote the quality of microbiological meat (Kabir, 2009).

Complementary and alternative medicine are in huge demand for use along with probiotics organism. Although, garlic is considered as a plant with antibiotic, anticancer, antioxidant, immune-modulatory, anti-inflammatory, hypoglycemic and cardiovascular- protecting effects. Garlic supplement to broiler feeds has been recognized for its strong stimulating effect on the immune system in addition to its positive effects on digestion in birds due to the very rich aromatic essential content of it.

After the ban of application of sub-therapeutic levels of antibiotics, development and application of non-antibiotic alternatives like probiotics as performance enhancers are increasing. There is not much information about the effect of these prebiotic and probiotics on broiler performance. Therefore, the present experiment has been done on the functionality of garlic (pre-biotic) and multi-strain probiotics on growth performance, nutrient digestibility, anti-oxidant profile, carcass profile and economy of production of broiler bird**.**

## Materials and Methods

The experiment was conducted in the experimental poultry shed of the Department of Animal Nutrition, College of Veterinary Science, Guwahati, India. One hundred eighty no. (N=180) of day old commercial Ven Cobb 50 broiler chicks were randomly distributed into 4 treatment groups *i.e*., $T_0$, $T_1$, $T_2$ and $T_3$ on the basis of their body weight. Each treatment group having three replicates of 15chicks each (n=45 chicks/ treatment). Experimental diets were formulated for starter and finisher phases to meet the nutrient requirement as per ICAR (2013) using commonly available ingredients (Table1). The experimental protocol was approved by the institutional animal ethics committee (IAEC) with approval No. 770/ GO/Re/S/03/ CPCSEA/FVSc/ AAU/IAEC/18-19/674 and carried out as per the guidelines of the Committee for the Purpose of Control and Supervision of Experiments in Animals (CPCSEA), Ministry of Environment, Forests and Climate Change, Government of India. For this current experiment, the best LAB was identified as *Pediococcus acidilactici* FT28 by 16S rRNA sequencing and was used as probiotic in the present experiment (Accession No. KU837246) obtained from IVRI, Izatnagar screened from faeces of pigs. *Lactobacillus acidophilus* NCDC15 was obtained from the culture collection (Dairy Microbiology Department, NDRI, Karnal, India). The cultures were inoculated in MRS (Man Rogosa and Sharpe) broth (Difco) and incubated at 37°C for overnight in BOD incubator under aerobic condition.

One of the active principles present in garlic is Inulin. It was estimated with slight modification of standard method by Sharma (2009). Inulin is a polymer of fructose β-alpha-2-1 linkage. It was extracted first by washing the sample powder with 80% alcohol to remove soluble sugars. Mostly parameters like body weight, feed intake, digestibility, blood biochemical profile, carcass traits and antioxidant profile were measured.

## Results and Discussion

Data for weekly feed intake presented in table 4 and results of the experiment found that there is no significant different ($P>0.05$) among the groups when garlic + MSP were added in the diet of the broiler birds.

Digestibility of all the feed nutrients are presented in the table 5 where no significant ($P>0.05$) effect found in terms of digestibility of nutrients and nitrogen retention. The digestibility of nutrients and N retention were not showing any significant effect except NFE digestibility which was significantly highest in $T_2$ group.

The carcass characteristics like dressing percentage, pre-slaughter weight, giblet weight and lymphoid organ weight did not differ significantly (P>0.05) among the groups which was presented in table 7.

The prime cuts did not differ significantly (P>0.05) among the groups. At the end of the experiment, the economics of the experimental diets on the performance of broiler on supplementation of Garlic and Multi-strain Probiotic was worked out. The results of the present experiment revealed that the birds grew efficiently when diet containing 0.5% garlic was fed in the treatment group. On the other hand cost of production per kg live weight gain was also lowest in $T_3$ group where 0.75% garlic was incorporated. As consumption of multi strain probiotics alone reduce oxidative damage, free radical scavenging rate and modification in activity of crucial antioxidative enzymes in cells. Due feeding of synbiotics antioxidant profile of experimental birds presented in table 6, where erythrocytic reduced glutathione which was significantly (P<0.05) better in $T_0$, $T_2$ and $T_3$ groups as compared to $T_1$ group.

From the results it was observed that supplementation of 0.50% garlic and multi-strain probiotics significantly affected the body weight gain. The body weight gain was observed less in $T_3$ group with 0.75% garlic powder and multi-strain probiotics was incorporated. Fadlalla *et al.,* (2010) observed non significant increase of body weight by inclusion of 0.3% garlic in the diet. Toghyani *et al.,* (2011) observed increase of body weight and FCR when cinnamon and garlic powder was incorporated @ 2g/kg in broiler diet. Elagib *et al.,* (2013) also found improvement in body weight gain when garlic powder was incorporated @ 3% level without any side effect. The results of this present experiment obtained in respect of growth performance were in good agreement with Toghyani *et al.,* (2011) and Elagib *et al.,* (2013).This results might be due to good health status of broilers due to inclusion of garlic along with multistrain probiotics. The best feed conversion ratio was significantly (P<0.05) obtained by the diet with 1.0% level of garlic powder. The better feed conversion ratio can be attributed to the anti-bacterial properties of the garlic powder which resulted in better absorption of the nutrients in the gut and finally leading to improvement in feed conversion ratio. Similar observations were reported in broiler chicken by several workers (Lukanov *et al.,* 2015 and Karangiya *et al.,* 2016) who found significantly (P<0.05) improved FCR due to supplementation of garlic powder at various levels. Contrary to the present findings, Issa and Omer, (2012) and Amouzmehr *et al.,* (2013) found no significant differences in FCR due to supplementation of garlic powder in feed of broiler chickens. The improved performance traits in respect of feed consumption, body weight and FCR in garlic treated groups might be due to the fact that garlic contained high levels of allicin, diallyl disulfide and S-methylcysteine sulfoxide (Chi *et al.,* 1982 and Lee *et al.,* 2000). Another possible results may be due to after overcoming the stress, normal gut microflora is re established (Pluske, 2001) which leads to better feed digestion resulting in improved immunity, therefore probiotic feeding at this stage is no more as effective as in early stage. It was reported by Elagib *et al.,* (2013) that including increase feed intake while incorporating garlic powder @ 3% in broiler diet without any side effect. Ramiah *et al.,* (2014) observed better feed intake while feeding 0.5% garlic powder along with basal diet. Lukanov *et al.,* (2018) observed efficient FCR on feeding probiotics and garlic powder to broilers. In present investigation the results obtained in $T_2$ group had better FCR than the $T_3$ group but there was no significant effect of feeding garlic powder @ 0.25% and 0.75% and multi-strain probiotics. The result of the present experiment are in good agreement with Fadlalla *et al.,* (2010), Raesi *et al.,* (2010), Mansoub *et al.,* (2011), Ramiah *et al.,* (2014) and Lukanov *et al.,* (2018).The digestibility co-efficient of dry matter was almost similar among all the groups. Issa and Omer, (2012) observed significantly improved digestibility of DM, EE, CP on feeding garlic powder @ 0.2%, 0.4% level. Singh *et al.,* (2017) observed no significant effect on DM, EE, Nitrogen retention digestibility while incorporating garlic powder to the basal diet.

**Table.1** Ingredients and chemical composition of basal diets for grower and finisher stage of chicken

| Items | Grower (0-21 days) | Finisher(22-35 days) |
|---|---|---|
| **Ingredients, %** | | |
| **Maize** | 44.3 | 51 |
| **Soyabean meal** | 21.5 | 22 |
| **Rice polish** | 10 | 10 |
| **Groundnut cake** | 18.5 | 11.4 |
| **Vegetable oil** | 3.5 | 3.5 |
| **Common salt** | 0.5 | 0.5 |
| **Mineral mixture** | 1.5 | 1.5 |
| **Lysine** | 0.067 | - |
| **Methionine** | 0.133 | 0.1 |
| **Total** | 100 | 100 |
| **Calculated chemical composition** | | |
| **Crude protein, %** | 21.56 | 19.64 |
| **Metabolizable energy (kcal/kg)** | 3048 | 3129.3 |
| **Lysine** | 1.2 | 0.99 |
| **Methionine** | 0.5 | 0.4 |

*$T_0$, control (basal diet), $T_1$, basal diet + 0.25% garlic powder (GP)+ multi-strain probiotic (MSP), $T_2$ , basal diet + 0.50% GP + MSP, $T_3$ = basal diet + 0.75% GP + MSP

**Table.2** Effects of garlic along with MSP on growth performance

| Attributes | $T_0$ | $T_1$ | $T_2$ | $T_3$ | P value |
|---|---|---|---|---|---|
| **Initial body weight (g)** | 115.75±4.17 | 118.37±0.16 | 112.33±0.00 | 117.11±0.59 | 0.111 |
| **Final body weight (g)** | $1676^{b}$±0.11 | $1725^{c}$ ±0.13 | $1765^{d}$±0.16 | $1520^{a}$±0.03 | <0.001 |
| **Total net gain(g)** | $1570^{b}$±4.16 | $1607^{c}$±0.21 | $1653^{d}$±0.16 | $1403^{a}$±0.59 | <0.001 |
| **Feed conversion ratio** | $1.80^{a}$±0.03 | $1.81^{a}$±0.02 | $1.78^{a}$±0.01 | $2.07^{b}$±0.01 | 0.010 |
| **BPEI** | $68.26^{ab}$±4.52 | $82.63^{b}$±5.90 | $76.75^{ab}$±7.91 | $62.01^{a}$±1.48 | 0.011 |

*$T_0$ , control (basal diet), $T_1$, basal diet + 0.25% garlic powder (GP)+ multi-strain probiotic (MSP), $T_2$, basal diet + 0.50% GP + MSP, $T_3$ = basal diet + 0.75% GP + MSP

**Table.3** Effects of garlic along with MSP on Feed intake

| Age in week | Treatment | | | | SEM | P value |
|---|---|---|---|---|---|---|
| | $T_0$ | $T_1$ | $T_2$ | $T_3$ | | |
| **2nd week** | 298.33±0.88 | 300.56 ± 2.28 | 301.33 ±3.53 | 301.66 ± 1.89 | 1.07 | 0.751 |
| **3rd week** | $382.03^{a}$ ± 6.65 | $384.67^{a}$ ± 4.23 | $411.11^{b}$ ± 1.56 | $411.33^{b}$ ±2.40 | 4.57 | <0.001 |
| **4th week** | 608.89 ± 34.79 | 628.22 ± 15.56 | 645.78 ± 6.33 | 633.11 ± 9.02 | 9.36 | 0.635 |
| **5th week** | $800.00^{a}$ ± 2.89 | $800.00^{a}$ ± 1.15 | $810.33^{b}$ ± 1.45 | $799.22^{a}$ ± 3.05 | 1.70 | 0.026 |
| **6th week** | $840.00^{a}$ ± 1.15 | $840.67^{a}$ ± 1.20 | $850.00^{b}$ ± 2.52 | $840.00^{a}$ ±1.53 | 1.47 | 0.007 |
| **Total FI** | 2929.25±39.36 | 2954.11±20.96 | 3018.55±1.83 | 2935.32±4.53 | 13.91 | 0.097 |

*$T_0$, control (basal diet), $T_1$, basal diet + 0.25% garlic powder (GP)+ multi-strain probiotic (MSP), $T_2$, basal diet + 0.50% GP + MSP,$T_3$, = basal diet + 0.75% GP + MSP

**Table.4** Effects of garlic along with MSP on Anti-oxidant profile

| Attributes | $T_0$ | $T_1$ | $T_2$ | $T_3$ | P value |
|---|---|---|---|---|---|
| **Catalase (U/mg protein)** | 2.20±1.6 | 1.77±2.59 | 2.48±4.17 | 0.46±0.27 | 0.002 |
| **SOD (U/mg protein)** | 2.00±0.46 | 1.84±0.69 | 2.16±0.95 | 1.85±1.08 | 0.113 |
| **Reduced glutathione (nM/mg protein)** | $26.51^{b}$±9.76 | $18.54^{a}$±6.39 | $26.33^{b}$ ±6.95 | $26.32^{b}$ ±14.3 | <0.001 |

*$T_0$, control (basal diet), $T_1$, basal diet + 0.25% garlic powder (GP)+ multi-strain probiotic (MSP), $T_2$, basal diet + 0.50% GP + MSP,$T_3$, = basal diet + 0.75% GP + MSP

**Table.5** Effects of garlic along with MSP on Carcass profile

| Attributes | Dietary treatments | | | | SEM | P value |
|---|---|---|---|---|---|---|
| | $T_0$ | $T_1$ | $T_2$ | $T_3$ | | |
| **PSW (kg)** | 2.10±0.17 | 2.52±0.08 | 2.31±0.10 | 2.18±0.04 | 0.06 | 0.083 |
| **WCB (kg)** | 2.02±0.18 | 2.45±0.06 | 2.21±0.10 | 2.10±0.05 | 0.06 | 0.051 |
| **ECW (kg)** | $1.5^{a}$±0.12 | $1.85^{b}$±0.03 | $1.71^{ab}$±0.07 | $1.64^{ab}$±0.02 | 0.04 | 0.033 |
| **Dressing%** | 71.56±0.89 | 73.70±1.37 | 74.18±1.10 | 75.21±1.22 | 0.60 | 0.191 |
| **Total intestine weight with content** | 7.4±0.57 | 7.97±0.23 | 6.85±0.19 | 6.56±0.62 | 0.23 | 0.160 |

*$T_0$: control (basal diet), $T_1$: basal diet + 0.25% garlic powder (GP)+ multi-strain probiotic (MSP), $T_2$: basal diet + 0.50% GP + MSP, $T_3$ :basal diet + 0.75% GP + MSP

**Table.6** Effects of garlic along with MSP on Prime cuts

| Attributes | Dietary treatments | | | | SEM | P value |
|---|---|---|---|---|---|---|
| | $T_0$ | $T_1$ | $T_2$ | $T_3$ | | |
| **Neck** | 5.23±0.29 | 5.40±0.04 | 5.17±0.17 | 4.48±0.39 | 0.14 | 0.102 |
| **Wing** | $7.5^{a}$±0.20 | $7.4^{a}$±0.32 | $7.5^{a}$±0.15 | $8.5^{ab}$±0.30 | 0.15 | 0.025 |
| **Back** | 13.36±0.69 | 15.74±0.50 | 14.37±0.45 | 14.55±0.77 | 0.33 | 0.090 |
| **Drumstick** | 9.92±0.23 | 9.68±0.22 | 10.89±0.54 | 10.37±0.13 | 0.18 | 0.094 |
| **Thigh** | 9.89±0.76 | 10.39±0.42 | 10.90±0.78 | 11.30±0.42 | 0.31 | 0.433 |
| **Breast** | 21.74±0.37 | 21.78±0.59 | 21.34±0.86 | 22.58±0.51 | 0.30 | 0.548 |

*$T_0$: Control (basal diet), $T_1$: Basal diet + 0.25% garlic powder (GP)+ multi-strain probiotic (MSP), $T_2$ : basal diet + 0.50% GP + MSP, $T_3$ : basal diet + 0.75% GP + MSP

**Table.7** Effect of garlic along with MSP on economics of feeding

| Treatment | Feed Consumed (kg) | Feed cost per kg (Rs) | Cost of feeding (Rs) | Total Body weight gain (kg) | Total cost/ bird |
|---|---|---|---|---|---|
| $T_0$ | 2.93 | 32.00 | 93.81 | 1.68 | 152.11 |
| $T_1$ | 2.96 | 33.00 | 95.62 | 1.73 | 154.14 |
| $T_2$ | 3.02 | 34.00 | 98.69 | 1.77 | 157.58 |
| $T_3$ | 2.99 | 37.00 | 98.74 | 1.52 | 157.63 |

*$T_0$: Control (basal diet), $T_1$: Basal diet + 0.25% Garlic powder (GP)+ Multi-strain probiotic (MSP), $T_2$ : Basal diet + 0.50% GP + MSP, $T_3$ : Basal diet + 0.75% GP + MSP

Hossain *et al.,* (2015) observed improved DM and nitrogen digestibility on feeding multi-strain probiotics in broiler birds. In present experiment, the DM digestibility did not differ significantly among all the groups but in $T_2$ group there was slight improvement in DM digestibility. So, the results of this experiment are in good agreement with Singh *et al.,* (2017). The possible reason behind improved digestibility is isolated probiotic bacteria from gut microflora might have propagated quickly in GIT to a very stable population and increased number of LAB in the gut was responsible for better nutrient utilization in pigs. Combine supplementation of garlic along with multistrain probiotics is uncommonly used as supplements in poultry feeds. It was found that it has some positive effect on human and animal health and immune response which reflected in positive effect on the animal performance (Fanelli *et al.,* 1998).The results of the present study showed that there was non-significant ($P<0.05$) effect on glucose and total protein found in among the treatment groups similarly, a significant ($P<0.05$) effect of serum triglycerides, cholesterol level found which is agree with the study conducted by Fadlalla *et al.,* (2010) and Toghyani *et al.,* (2011); Panda *et al.,* (2001); Amer *et al.,* (2012); Pourakbari *et al., (*2016); Mansoub (2011); Onyimonyi *et al.,* (2011) and Karim *et al.,* (2017). The variations in blood profile is due to optimum low density lipid (LDL) and cholesterol caused by garlic inclusion as reported by Reuter *et al.,* 1998.Propolis also natural alternative product for garlic.

The result of the present investigation in respect of organ weight and prime cuts is in good agreement with Aziz *et al.,* (2016); El-Katcha *et al.,* (2016) and Onibi *et al.,* (2009). The result of the carcass parameter in present experiment are in good agreement with Abdullah *et al.,* (2010); Elagib *et al.,* (2013); Anjum *et al.,* (2005); Pourakbari *et al.,* (2016) and in respect of abdominal fat also the result obtained in the present experiment are in good agreement with Milosevic *et al.,* (2013) and Oleforuh-Okoleh *et al.,* (2014). On statistical analysis revealed that neck, wing, back, drumstick, thigh and breast had no significant ($P<0.05$) effect on feeding garlic powder and multi-strain probiotics at different levels to broilers. The result of the present investigation in respect of organ weight and prime cuts is in good agreement with Aziz *et al.,* (2016); El-Katcha *et al.,* (2016) and Onibi *et al.,* (2009).

Fecal microbial status is widely used as an indicator to assess the intestinal microbial colonization (Goldin, 1998). Lactic acid bacteria when used as probiotics make GIT healthier by maintaining its environment and reducing pathogens resulting in improvement of health status of pigs (Yang *et al.,* 2015). The caecal microbial profile found highest concentration of LAB was observed in $T_2$ group (8.18±0.03) and lowest concentration was found in $T_0$ group (6.31±0.16) $\log_{10}$ cfu/g caecal content. In the present investigation there was increase in LAB count when garlic powder and multi-strain probiotics was incorporated in the diet @ 0.25% and 0.50%.Similarly the count of *E.coli* decreased and results of the present experiment is in good agreement with Ramiah *et al.,* (2014); Strompfa *et al.,* (2005) and Li *et al.,* (2014). At the end of the experiment, the economics of the experimental diets on the performance of broiler on supplementation of Garlic and Multi-strain Probiotic was worked out.

The results of the present experiment revealed that the birds grew efficiently when diet containing 0.5% garlic was fed in the treatment group. On the other hand cost of production per kg live weight gain was also lowest in $T_3$ group where 0.75% garlic was incorporated.

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## References

Abdullah, Y. A., M. Z. Mahmoud, B. M. Nusairat and Qudsieh, I. R. 2010. Small intestinal

histology, production parameters, and meat quality as influenced by dietary supplementation of garlic (*Allium sativum*) in broiler chicks. Ital J Anim Sci. 9:80.

Alagawany, M., M. E. Abd El- Hack, M. Arif and Ashour, A.E. 2017.Individual and combined effects of crude protein, methionine and probiotic levels on laying hen productive performance and nitrogen pollution in the manure. Environ. Sci.Poll. Res. 23:22906-22913.

Amer, M. Y. and Khan, S. H. 2012.A comparison between the effects of a probiotic and an antibiotic on the performance of Desi chickens.Vet. World. 5(3):160-165, doi: 10.5455/vetworld.2012.160-165

Amouzmehr, A., B. Daster, G. J. Nejad, I.K. Sung, J. Lohakare and Forghani, F. 2013. Effect of garlic and thyme extracts on growth performance and carcass characteristics of broiler chicks. Journal of Animal Science and Technology.54: 185-190.

Anjum, M. I., G. A. Khan, A. Azim and Afzal, M. 2005. Effect of dietary supplementation of multi-strain probiotic on broiler growth performance. Pakistan Vet. J. 25(1).

Aziz, A. A., R. H. Majeed and Muhammad, A. A. 2016. Effect of adding different levels of garlic powder to diets on broiler performance. Iraqi J. Poultry Sci. 10 (1): 77 – 88.

Chi, M. S., H. Koh and Steward, T. J. 1982. Effects of garlic on lipid metabolism in rat fed cholesterol or lard. Journal of Nutrition.112:241-248.

Elagib, H. A. A., A. I. W. El-Amin, M. K. Elamin and Malik, H. E. E. 2013. Effect of Dietary Garlic (*Allium sativum*) Supplementation as Feed Additive on Broiler Performance and Blood Profile. J. Anim. Sci. Adv.3(2):58-64.

El-katcha, M. I., A. M. Soltan, M. M. Sharaf and A. Hasen (2016). Growth Performance, Immune Response, Blood serum parameters, Nutrient Digestibility and Carcass Traits of Broiler Chicken as Affected by Dietary Supplementation of Garlic Extract (Allicin). Alexandria Journal of Veterinary Sciences. 49 (2): 50- 64.

Fadlalla, I. M. T., H. B. Mohammed and Bakhiet, A. O. 2010. Effect of Feeding Garlic on the Performance and Immunity of Broilers. Asian Journal of Poultry Science. 4 (4): 182-189.

Fanelli, S. L., G. D. Castro, Toranzo, E. G. D. and Castro, A. J. 1998. Mechanisms of the preventive properties of some garlic components in the carbon tetrachloride-promoted oxidative stress. Diallyl sulfide; diallyl disulfide; allyl mercaptan and allyl methyl sulfide. Res. Commun. Mol. Pathol. Pharmacol.102: 163-174.

Hossain, M. M., M. Begum and Kim, H. I. 2015. Effect of *Bacillus subtilis*, *Clostridium butyricum* and *Lactobacillus acidophilus* endospores on growth performance, nutrient digestibility, meat quality, relative organ weight, microbial shedding and excreta noxious gas emission in broilers.Veterinarni Medicina. 60 (2): 77–86.

ICAR. 2013. Nutrient Requirements of Poultry. Indian Council of Agricultural Research, New Delhi, India.

Issa, K. J. and Omar, J. M. A. 2012. Effect of garlic powder on performance and lipid profile of broilers. Open J. of Animal Sci. 2(2): 62-68.

Kabir, S. M. L. 2009. The Dynamics of prebiotics in enhancing poultry meat, production and quality. Department of Microbiology and Hygiene, Faculty of Veterinary science. Bangladesh Agricultural University.Int. J. Poult.Sci.3:361-364.

Karangiya, V. K., H. H. Savsani, S. S. Patil, D. D. Garg, K. K. Murthy, K. N. Ribadiya and Vekariya, S. J. 2016. Effect of dietary supplementation of garlic, ginger and their combination on feed intake, growth performance and economics in commercial broilers.Veterinary World. 9(3): 245-250.

Karim, M. B., A. M. Hossain and Hossain, S. M. 2017. Effect of garlic powder (*Allium sativum*) on growth, dressing parameters, serum biochemical contents and profitability

of broiler. Bangladesh Journal of Animal Science.46 DOI - 10.3329/bjas.v46i4.36961.

Lee, M. C., J. E. Wang, C. Lee, T. K. Chin, D. Liu, F. J. Chiu and Kung, H.F. (2000). Garlic inhibits microsomal triglyceride transfer protein gene expression in human liver and intestinal cell lines and in rat intestine. Journal of Nutrition. 8:1165-1168.

Li, Y. B., Q. Q. Xu, J. C. Yang, X. Yang, L. Lv, Yin, C. H., Liu, X. L. and H. Yan. 2014. Effects of probiotics on the growth performance and intestinal micro flora of broiler chickens. Pakistan Journal of Pharmaceutical Sciences. 27.

Lukanov, H., A. Genchev and S. Ribarski. 2015. Effect of feed supplementation with garlic powder on meat productivity and meat quality traits of Classic Ross 308 male hybrid chickens. Trakia Journal of Science. 13(1): 66-76.

Mansoub, N. H. 2011.Comparative Effects of Using Garlic as Probiotic on Performance and Serum Composition of Broiler Chickens. Ann. of Biol. Res. (3):486-490.

Milosevic, N., V. Stancev, L. Peric, D. M. Stojcic and M. Veljic, M. 2013. Effects of garlic on production parameters and slaughter traits (yield and individual carcass parts, weight of internal organs and quantity of abdominal fat) of broiler chickens. Archiv für Geflügelkunde. 77:254-259.

Oleforuh-Okoleh, U. V., G. C. Chukwu and Adeolu, I. A. 2014. Effect of ground ginger and garlic on the growth performance, carcass quality and economics of production of broiler chickens. G.J.B.B. 3 (3): 225-229.

Onibi, G. E., E. O. Adebisi, N, A. Fajemisin and Adetunji, A. V. 2009.Response of broiler chickens in terms of performance and meat quality to garlic (*Allium sativum*) supplementation. African J. of Agricultural Research. 4 (5): 511-517.

Onyimonyi, A. E., C. P. Chukwuma and Igbokwe, C. 2011. Growth and hypocholesterolemic properties of dry garlic powder (*Allium sativum*) on broilers. African Journal of Biotechnology. 11(11): 2666-71.

Panda, A. K., R. M. Reddy and Praharaj, N. K. 2001.Dietary supplementation of probiotic on growth, serum cholesterol and gut microflora of broilers. Indian Journal of Animal Science. 71: 488-490.

Pelicano, E. R. L., S. Oba, M. M. Boiage, N. M. B. L. Zeola, A. M. Scatolinni, A.V. Bertanha and Lima, A. M. T. 2005. Carcass and cut yields and meat qualitative traits of broiler fed diets containing probiotics and prebiotics.Rev. Bras ciene Avic.7:169-175.

Pourakbari, M., A. Seidavi, L. Asadpour and Martínez, A. 2016. Probiotic level effects on growth performance, carcass traits, blood parameters, caecal microbiota and immune response of broilers. An Acad Bras Cienc. 88: 2

Raeesi, M., A. S. Hoeini-Aliabad, A. Roofchaee, A. Zare Shahneh and Pirali, S. 2010. Effect of periodically use of garlic (*Allium sativum*) power on performance and carcass characteristics in broiler chickens. World Academy of Science Engineering and Technology. 68: 1213-1219.

Ramiah, S. K., I. Zulkifli, A. A. N. Rahim, M. Ebrahimi and Meng, G. Y. 2014. Effects of Two Herbal Extracts and Virginiamycin Supplementation on Growth Performance, Intestinal Microflora Population and Fatty Acid Composition in Broiler Chickens. Asian Australas. J. Anim. Sci. 27(3): 375-382.

Reuter, H. D., H. P. Koch and Lawson, D. L. 1996. Therapeutic Effects and Application of Garlic and its Preparations. In: Garlic: The Science and Therapeutic Application of *Allium sativum* L. and Related Species, Koch, H. P. and L. D. Lawson (Eds.). Williams and Wilkins, Baltimore, MD., pp:135-213.

Sharma, R. K. and Sangha, S. P. S. 2009. Basic Techniques in Biochemistry and Molecular Biology. I. K. International Publishing House, Haryana, India.

Singh, J., Sethi, A. P. S., Sikka, S. S., Chateli, M. K.

and Kumar, P. (2017). Effect of sun dried whole bulb garlic powder on growth, carcass characteristics and meat quality of commercial broilers. The Indian Journal of Animal Science. 85(1): 67-71.

Soomro, R. N., M. E. Abd El- Hack, S. S. Shah, A. E. Taha, M. Alagawany, A. A. Swelum, E. O. S. Hussein, H. A. Ba- Aawdh, I. Saadeldin, A. M. El-Edel and Tufarelli, V. 2009.Impact of restricting feed and probiotic supplementation on growth performance, mortality and carcass traits of meat type quails. Animal. Sci. J.90:1388-1395.

Strompfova, V., M. Marcinakova, S. Gancarcikova, Z. Jonecova, L. Scirankova, P. Guba, J. Koscova, K. Boldizarova and Laukova, A. 2005. New probiotic strain Lactobacillus fermentum AD1 and its effect in Japanese quail. Vet. Med. 50 (9): 415-420.

Toghyani, M., A. Gheisari, G. Ghalamkari and Eghbalsaie, S. 2011. Evaluation of cinnamon and garlic as antibiotic growth promoter substitutions on performance, immune responses, serum biochemical and haematological parameters in broiler chicks. Livestock Science. 138:167–173.

Yang, F., A. Wang, X. Zeng, C. Hou, S..H. Liu and Qiao, S. 2015.Lactobacillus reuteri I5007 modulates tight junction protein expression in IPEC-J2 cells with LPS stimulation and in newborn piglets under normal conditions.BMC Microbiol, 15:32

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