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Article

Effects of black pepper, tulsi, peppermint, garlic, black cumin, papaya, cinnamon and patent probiotics on growth performance of broiler

Mohammad Rohul Amin*, Md. Mehedi Hasan Khokon, Nasrin Akter, Md. Nurul Al Imran, Md. Jasim Uddin and Md. Ahsanur Reza

Department of Physiology and Pharmacology, Faculty of Animal Science and Veterinary Medicine, Patuakhali Science and Technology University, Barishal-8210, Bangladesh

*Corresponding author: Professor Mohammad Rohul Amin, Department of Physiology and Pharmacology, Faculty of Animal Science and Veterinary Medicine, Patuakhali Science and Technology University, Khanpura, Babugonj, Barishal-8210, Bangladesh. Phone: +8801716404262; E-mail: mramin_bd@yahoo.com

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Abstract: The experiment was conducted in Department of Physiology and Pharmacology, FANSVM, PSTU to study the effects of seven indigenous medicinal plants [black pepper (*Piper nirgum*), tulsi (*Ocimum sanctum*), peppermint (*Mentha piperita*), garlic (*Allium sativum*), black cumin (*Nigella sativa*), papaya (*Carica papaya*), cinnamon (*Cinnamomum verum*)] and two patent probiotics (SS Bio® and Poultrystar Sol®) on the growth performance (body weight and FCR) in broiler. The effects of black pepper, tulsi, peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® on hematological parameters (TEC, Hb and PCV) and biochemical parameter (blood glucose) were also observed. One hundred broiler were randomly divided into ten groups (A, B, C, D, E, F, G, H, I and J), each consisting of ten broiler. Group A was kept as control. 10% water extract of black pepper (seed), tulsi (leaves), peppermint (leaves), garlic (bulbs), black cumin (seed), papaya (leaves), cinnamon (bark) were administered orally to the broiler of group B, C, D, E, F, G and H, respectively. Broiler of group I and J received orally SS Bio® and Poultrystar Sol®, respectively. Black pepper, tulsi, peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® were significantly ($p<0.01$ and $p<0.05$) increased body weight and FCR up to the experimental period. TEC was significantly ($p<0.05$) increased at garlic treated broiler. After treatment with peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol®, Hb content increased significantly ($p<0.05$) in broiler. Black pepper, tulsi, peppermint, black cumin, papaya, SS Bio® and Poultrystar Sol® treatment significantly ($p<0.01$ and $p<0.05$) increased PCV in broiler. Peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® caused significantly ($p<0.01$ and $p<0.05$) increased blood glucose. Tulsi decreased ($p<0.05$) significantly blood glucose. The present study reveal that indigenous medicinal plants can be used as alternatives to patent probiotics in broiler.

Keywords: medicinal plants; probiotics; growth performance; broiler

1. Introduction

Medicinal plants have been used from the times immemorial for the treatment of various diseases in man and animals. More than 500 wild and cultivated medicinal plants of Bangladesh have so far been enumerated with information on their medicinal properties and uses (Ghani, 2003). These plants could become natural sources of new medicine. World Health Organization (WHO, 1993) has recognized the necessity for investigation and mobilization of ancient medicinal practices to fulfill the primary health care systems of the man and animals, and realizes that the traditional system of medicine may play an important role in the development of livestock of the third world countries. Utilization of medicinal plants is increasing due to prohibition of most of the antimicrobial growth promoters in animal feed because of their residual effects, plant extracts are becoming

more popular. They act as antibacterial, antioxidant, anticarcinogenic, antifungal, analgesic, insecticidal, anticoccidial and growth promoters. Majority of medicinal plants do not have the residual effects (Tipu *et al*., 2006).

The poultry industry has developed in several areas such as nutrition, genetics, management to maximizing the efficiency of growth performance and meat yield (Gunal *et al*., 2006). In modern poultry farming there is a major demand to produce high quality poultry meat and egg at low price without rely on antibiotics and other medicinal use in poultry feed and water. Antimicrobials have been used as feed supplement for more than 50 years in poultry feed to enhance the growth performance and to prevent diseases in poultry. Probiotics are feed supplements that contain live microorganisms and promote beneficial effects to the host by improving the balance of the intestinal microbes (Fuller, 1989). Various mechanisms have been proposed which are include: (a) the nutrients are more efficiently absorbed and less are utilised by the gut wall, (b) more nutrients are available to the host because of a reduced intestinal microflora, (c) there is a reduction in harmful gut bacteria, (d) production of growth suppressing toxins or metabolites is reduced, (e) microbial de-conjugation of bile acids is decreased (Ohimain and Ofongo, 2012). Probiotics has been successfully used at subtherapeutic doses in poultry production to promote growth and protect health of the birds (Engberg *et al*., 2000). Probiotics were supposed to increase growth rate as a result of improved gut health, resulting in better nutrient utilization and decreased feed conversion ratio (Visek, 1978).

Many synthetic drugs and probiotics are supplemented to broiler diets to effect rapid growth, but their use have shown many disadvantages like high cost, adverse side effect on health of birds and long residual properties and carcinogenic effect in human (Butaye *et al.*, 2003). Since consumers are aware of the residual effects of patent drugs in poultry meat that is why they demand drug-free food products. This has led to the search of alternative natural growth enhancers such as plants and their extracts. Production performance and feed efficiency are closely interrelated with the qualitative and quantitative microbial load of the animal gut, the morphological structure of the intestinal wall and the activity of the immune system (Huyghebaert *et al.*, 2011). Herbal products with attention to their availability, application are used as side effect-less antibacterial and antioxidant supplements from many years ago (Khaligh *et al*., 2011). The experiment was conducted to assess the effects of seven indigenous medicinal plants [black pepper (*Piper nirgum*), tulsi (*Ocimum sanctum*), peppermint (*Mentha piperita*), garlic (*Allium sativum*), black cumin (*Nigella sativa*), papaya (*Carica papaya*), cinnamon (*Cinnamomum verum*)] and two patent probiotics (SS Bio® and Poultrystar Sol®) on the growth performance, hematological and biochemical parameter in broiler.

2. Materials and Methods

The experiment was performed in the Department of Physiology and Pharmacology, Faculty of Animal science and Veterinary Medicine (FANSVM), Patuakhali Science and Technology University (PSTU), Barishal for a period of 28 days. The research was carried out during 6th November, 2017 to 3rd December, 2017. One hundred Cobb-500 broiler chicks purchased from a hatchery (Kazi Poultry and Hatchery Ltd.) were selected for this study. The broiler chicks were kept on a floor litter system. The broiler was reared in same management. Broiler chicks were randomly divided into ten groups (A, B, C, D, E, F, G, H, I and J), each group consisting of ten (10) broiler. Group A was kept as control group received only basal feed. 10% water extract of black pepper (*Piper nirgum*) seed, tulsi (*Ocimum sanctum*) leaves, peppermint (*Mentha piperita*) leaves, garlic (*Allium sativum*) bulbs, black cumin (*Nigella sativa*) seed, papaya (*Carica papaya*) leaves, cinnamon (*Cinnamomum verum*) bark were administered orally to the broiler of group B, C, D, E, F, G and H, respectively with basal feed. Broiler of group I and J received orally SS Bio® (ACI Animal Health Limited, Bangladesh) and Poultrystar Sol® (Renata Limited, Bangladesh), respectively with basal feed. Growth performance (body weight and FCR) were examined on 7th, 14th, 21st and 28th day in broiler. Hematological parameters (TEC, Hb and PCV) were determined on the 28th day by the standard method as described by Coffin (1953). Biochemical parameter (blood glucose) was recorded on 14th, 21st and 28th day by the help of Glucometer. Collected data were statistically analyzed by Student's t-test by using the computer statistical package program of Microsoft Excel.

3. Results and Discussion

3.1. Effects of seven indigenous medicinal plants and two patent probiotics on the growth performance of broiler

3.1.1. Live body weight

The results of the effect of seven indigenous medicinal plants and two patent probiotics on body weight were shown in the Table 1. The body weight was increased significantly ($p<0.01$ and $p<0.05$) after black pepper, tulsi, peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® treatment in group B, C,

D, E, F, G, H, I and J, respectively. On the 7th day body weight was 169.00±6.51, 173.80±2.01, 174.60±2.29, 163.20±12.38, 173.60±4.33, 197.40±5.17, 191.60±5.17, 168.80±15.25, 172.80±9.14 and 174.00±11.35, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 14th day body weight was 445.00±9.35, 448.00±4.04, 459.20±4.09, 441.20±25.83, 457.00±4.47, 492.40±8.79, 486.80±11.51, 433.60±64.67, 453.60±4.39 and 450.80±43.96, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 21st day body weight was 912.00±9.08, 916.00±4.52, 917.60±5.46, 899.20±33.52, 935.40±0.54, 981.40±8.38, 971.80±6.76, 937.60±45.46, 928.00±5.65 and 882.00±66.78, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 28th day body weight was 1455.00±21.70, 1459.20±9.86, 1462.40±8.50, 1531.00±78.77, 1492.00±6.71, 1569.40±11.99, 1566.00±10.41, 1444.00±63.77, 1486.00±1.51 and 1510.20±47.91, respectively in groups A, B, C, D, E, F, G, H, I and J. The present finding was agreement with the works of Elkhair *et al.* (2014) and Moorthy *et al.* (2009) for black pepper, Hasan *et al.* (2016) and Mode *et al.* (2009) for tulsi, Asadi *et al.* (2017) and Gurbuz and Ismael (2016) for peppermint, Borgohain *et al.* (2017) and Sheoran *et al.* (2017) for garlic, Kumar and Patra (2017) and Erener *et al.* (2010) and for black cumin, Mahejabin *et al.* (2015) and Unigwe *et al.* (2014) for papaya, Mehdipour and Afsharmanesh (2018) and Toghyani *et al.* (2011) for cinnamon.

3.1.2. Feed conversion ratio (FCR)

The results of the effect of seven indigenous medicinal plants and two patent probiotics on feed conversion ratio (FCR) were shown in the Table 2. The FCR was increased significantly ($p<0.01$ and $p<0.05$) after black pepper, tulsi, peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® treatment in group B, C, D, E, F, G, H, I and J, respectively. On the 7th day feed conversion ratio (FCR) was 0.98±0.03, 0.96±0.01, 0.96±0.01, 1.03±0.08, 0.96±0.01, 0.85±0.02, 0.87±0.02, 0.99±0.09, 0.96±0.03 and 0.96±0.06, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 14th day FCR was 1.12±0.02, 1.21±0.01, 1.20±.01, 1.23±0.07, 1.18±0.01, 1.10±0.02, 1.11±0.03, 1.27±0.20, 1.19±0.02 and 1.21±0.12, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 21st day FCR was 1.31±0.01, 1.31±0.01, 1.30±0.01, 1.33±0.05, 1.28±0.01, 1.22±0.01, 1.23±2.70, 1.28±0.06, 1.29±0.01 and 1.36±0.01, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 28th day FCR was 1.47±0.02, 1.47±0.01, 1.47±0.01, 1.46±0.07, 1.43±0.02, 1.37±0.01, 1.37±2.87, 1.43±0.06, 1.45±0.02 and 1.42±0.04, respectively in groups A, B, C, D, E, F, G, H, I and J. Similar observations were reported by Shahverdi *et al.* (2013) and Moorthy *et al.* (2009) for black pepper, Sheoran *et al.* (2017) and Hasan *et al.* (2016) for tulsi, Asadi *et al.* (2017) and Gurbuz and Ismael (2016) for peppermint, Borgohain *et al.* (2017) and Sheoran *et al.* (2017) for garlic, Erener *et al.* (2010) and Mansoori *et al.* (2006) for black cumin, Mahejabin *et al.* (2015) and Unigwe *et al.* (2014) for papaya, Mehdipour and Afsharmanesh (2018) and Toghyani *et al.* (2011) for cinnamon.

3.2. Effects of indigenous medicinal plants and patent probiotics on hematological parameters in broiler

The results of the effect of seven indigenous medicinal plants and two patent probiotics on hematological parameters were shown in the Table 3.

3.2.1. Total erythrocyte count (TEC, million/cu.mm.)

Black pepper, tulsi, peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® caused changes on total erythrocyte count (TEC) at 28th day in broiler. Garlic increased significantly ($p<0.05$) TEC at the broiler of group E. On the 28th day TEC was 4.48±0.25, 4.52±0.09, 4.56±0.08, 4.50±0.55, 4.58±0.08, 4.52±0.33, 4.54±0.31, 4.50±0.63, 4.50 ± 0.07 and 4.52±0.61, respectively in groups A, B, C, D, E, F, G, H, I and J. In conformity to the present findings, Fasuyi and Oloyede (2017) and Toghyani *et* al. (2011) stated that garlic increased TEC in broiler.

3.2.2. Hemoglobin content (Hb, gm %)

The hemoglobin (Hb) content was also increased significantly ($p<0.05$) after peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® treatment in group D, E, F, G, H, I and J, respectively. On the 28th day Hb was 11.60±0.83, 1.78±0.37, 11.78±0.35, 11.96±0.99, 12.50±0.18, 12.76±0.93, 12.24±0.54, 12.44±1.23, 12.10±0.55 and 12.08±1.31, respectively in groups A, B, C, D, E, F, G, H, I and J. This results was in conformity with earlier reports made by Toghyani *et al.* (2011) for garlic, Toghyani *et al.* (2010) for peppermint, Khan *et al.* (2012) and Toghyani *et al.* (2010) for black cumin, Agboola *et al.* (2018) for papaya, Khafaji (2018) for cinnamon.

3.2.3. Packed cell volume (PCV, %)

The packed cell volume (PCV) was increased significantly ($p<0.01$ and $p<0.05$) after black pepper, tulsi, peppermint, black cumin, papaya, SS Bio® and Poultrystar Sol® treatment in group B, C, D, F, G, I and J, respectively. On the 28th day PCV was 34.58±1.17, 34.72±0.54, 34.80±0.55, 37.86±1.42, 34.64±0.90, 38.32±2.39, 39.40±1.57, 34.70±2.46, 35.59±1.42 and 40.04±2.33, respectively in groups A, B, C, D, E, F, G, H, I and J. The results of the present study similar to the reports of Hasan *et al.* (2016) and Alom *et al.* (2015) for tulsi, Toghyani *et al.* (2010) for peppermint, Khan *et al.* (2012) and Toghyani *et al.* (2010) for black cumin, Agboola *et al.* (2018) for papaya.

3.3. Effect of indigenous medicinal plants and patent probiotics on biochemical parameter (blood glucose) of broiler

The results of the effect of indigenous medicinal plants and patent probiotics on biochemical parameter (blood glucose) were shown in the Table 4. The blood glucose was increased significantly ($p<0.01$ and $p<0.05$) after peppermint, garlic, black cumin, papaya, cinnamon, SS Bio® and Poultrystar Sol® treatment in group D, E, F, G, H, I and J, respectively. The blood glucose was decreased significantly ($p<0.05$) after tulsi treatment in group C. On the 14th day blood glucose was 13.38±0.42, 13.40±0.17, 13.24±0.23, 13.98±0.83, 13.38±0.63, 12.36±1.84, 12.84±1.56, 13.36±1.42, 13.38±0.41 and 14.24±0.38, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 21st day blood glucose was 13.28±0.52, 13.10±0.21, 13.18±0.48, 14.10±0.38, 13.92±0.35, 13.88±2.10, 14.62±1.36, 14.76±1.23, 13.86±0.41 and 14.78±1.23, respectively in groups A, B, C, D, E, F, G, H, I and J. On the 28th day blood glucose was 13.40±1.14, 13.48±0.54, 13.06±0.31, 14.78±1.05, 14.04±0.60, 14.24±1.87, 14.86±1.31, 14.84±2.08, 14.14±0.76 and 15.46±1.30, respectively in groups A, B, C, D, E, F, G, H, I and J. Similar observations were reported by Parasuraman *et al.* (2015) and Eevuri and Putturu (2013) for tulsi, Koochaksaraie *et al.* (2011) for cinnamon.

Table 1. Effects of indigenous medicinal plants and patent probiotics on body weight (gm) in broiler.

Group	Treatment	7th day	14th day	21st day	28th day
A	Control	169.00±6.51	445.00±9.35	912.00±9.08	1455.00±21.70
B	Black pepper	173.80±2.01	448.00±4.04*	916.00±4.52*	1459.20±9.86*
C	Tulsi	174.60±2.29	459.20±4.09**	917.60±5.46*	1462.40±8.50*
D	Peppermint	163.20±12.38	441.20±25.83*	899.20±33.52**	1531.00±78.77**
E	Garlic	173.60±4.33	457.00±4.47**	935.40±0.54**	1492.00±6.71**
F	Black cumin	197.40±5.17	492.40±8.79**	981.40±8.38**	1569.40±11.99**
G	Papaya	191.60±5.17	486.80±11.51**	971.80±6.76**	1566.00±10.41**
H	Cinnamon	168.80±15.25	433.60±64.67*	937.60±45.46**	1444.00±63.77**
I	SS Bio®	172.80±9.14	453.60±4.39	928.00±5.65**	1486.00±1.51**
J	Poultrystar Sol®	174.00±11.35	450.80±43.96**	882.00±66.78**	1510.20±47.91**

The above values represent the mean ± standard deviation (SD) of 10 broiler
** = Significant at 1 per cent level ($p<0.01$) * = Significant at 5 per cent level ($p<0.05$)

Table 2. Effects of indigenous medicinal plants and patent probiotics on feed conversion ratio (FCR) in broiler.

Group	Treatment	7th day	14th day	21st day	28th day
A	Control	0.98±0.03	1.12±0.02	1.31±0.01	1.47±0.02
B	Black pepper	0.96±0.01	1.21±0.01*	1.31±0.01*	1.47±0.01*
C	Tulsi	0.96±0.01	1.20±.01**	1.30±0.01*	1.47±0.01*
D	Peppermint	1.03±0.08	1.23±0.07	1.33±0.05*	1.46±0.07**
E	Garlic	0.96±0.01	1.18±0.01**	1.28±0.01**	1.43±0.02**
F	Black cumin	0.85±0.02	1.10±0.02**	1.22±0.01*	1.37±0.01**
G	Papaya	0.87±0.02	1.11±0.03**	1.23±2.70*	1.37±2.87**
H	Cinnamon	0.99±0.09	1.27±0.20*	1.28±0.06*	1.43±0.06**
I	SS Bio®	0.96±0.03	1.19±0.02**	1.29±0.01**	1.45±0.02**
J	Poultrystar Sol®	0.96±0.06	1.21±0.12	1.36±0.01*	1.42±0.04**

The above values represent the mean ± standard deviation (SD) of 10 broiler
** = Significant at 1 per cent level ($p<0.01$) * = Significant at 5 per cent level ($p<0.05$)

Table 3. Effects of indigenous medicinal plants and patent probiotics on hematological parameters (TEC, Hb content and PCV) at 28th day in broiler.

Group	Treatment	TEC (million/cu.mm.)	Hb content (gm %)	PCV (%)
A	Control	4.48±0.25	11.60±0.83	34.58±1.17
B	Black pepper	4.52±0.09	11.78±0.37	34.72±0.54*
C	Tulsi	4.56±0.08	11.78±0.35	34.80±0.55**
D	Peppermint	4.50±0.55	11.96±0.99*	37.86±1.42**
E	Garlic	4.58±0.08*	12.50±0.18*	34.64±0.90
F	Black cumin	4.52±0.33	12.76±0.93*	38.32±2.39**
G	Papaya	4.54±0.31	12.24±0.54*	39.40±1.57**
H	Cinnamon	4.50±0.63	12.44±1.23*	34.70±2.46
I	SS Bio®	4.50 ± 0.07	12.10±0.55*	35.59±1.42*
J	Poultrystar Sol®	4.52±0.61	12.08±1.31*	40.04±2.33**

The above values represent the mean ± standard deviation (SD) of 10 broiler
** = Significant at 1 per cent level (p<0.01) * = Significant at 5 per cent level (p<0.05)

Table 4. Effects of indigenous medicinal plants and patent probiotics on biochemical parameters (blood glucose) in broiler.

Group	Treatment	14th day	21st day	28th day
A	Control	13.38±0.42	13.28±0.52	13.40±1.14
B	Black pepper	13.40±0.17	13.10±0.21	13.48±0.54
C	Tulsi	13.24±0.23	13.18±0.48	13.06±0.31*
D	Peppermint	13.98±0.83	14.10±0.38	14.78±1.05**
E	Garlic	13.38±0.63	13.92±0.35**	14.04±0.60**
F	Black cumin	12.36±1.84	13.88±2.10**	14.24±1.87**
G	Papaya	12.84±1.56	14.62±1.36**	14.86±1.31**
H	Cinnamon	13.36±1.42	14.76±1.23*	14.84±2.08*
I	SS Bio®	13.38±0.41	13.86±0.41*	14.14±0.76**
J	Poultrystar Sol®	14.24±0.38	14.78±1.23*	15.46±1.30**

The above values represent the mean ± standard deviation (SD) of 10 broiler
** = Significant at 1 per cent level (p<0.01) * = Significant at 5 per cent level (p<0.05)

4. Conclusions

A large number of medicinal plants are scattered throughout Bangladesh. Poultry farming in Bangladesh is a very profitable business for both individuals and Entrepreneurs. There is huge demand of poultry products inside and outside of the country. Due to misuse/abuse of various chemicals/drugs, their residues are accumulated in the poultry bodies which can enter into the human body through food chain and various complexities develop in the human beings. Furthermore, frequent use of various chemicals/drugs increases the resistant population of parasites/microbes. But the food stuffs of poultry treated by the medicinal plants are not expected to produce such type of side effects.

Conflict of interest

None to declare.

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