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Original Research Article

Phytochemical Characterization of Certain Herbs and its Effect on Growth Performance in Growers

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A B S T R A C T

Antibiotics have been used for more than half a century in poultry feed for improving production performance, reducing pathogenic microbes and increasing beneficial microbes. But, because of the risk development of bio-resistance and the European Union ban on the use of antibiotics, it has escalated the search for the alternatives for use in poultry industry. The present study was undertaken to characterize certain herbs (*Ocimum sanctum*, *Zingiber officinale*, *Allium sativum*, *Trigonella foenum graceum* and *Curcuma longa*) phytochemically and to assess its effect on growth performance on oral feeding in eleven weeks old Lohman breed growers at different concentration @ 0.1, 0.25 and 0.5 % with 20 birds per group for twenty one days period. Control group was fed only with the regular feed and the three treatment groups were fed with the herbs at different levels in the regular feed. The herbs were subjected to phytochemical screening and their effect on weight gain was recorded. Our investigation revealed the presence of flavanoids and volatile oils and absence of tannin, hydrolysable tannin, phenol, cardiac glycosides and vitamin C. The result on growth performance indicated that the weight gain was in the normal range in the treatment groups as compared with the control which indicated better feed utilization and healthiness of the birds attributed to the improved digestion favoured by the presence of phytochemical constitutents and a protein digesting enzyme zingibain. The herbs could serve useful in enhancing the growth performance and feed consumption and act as a natural growth promoter and as a potential alternatives for common artificial growth promoters like antibiotics. However further studies are needed to assess the effect of the herbs on production performance of layers and to assess its effect on broilers so as to recommend the optimum level of feeding in poultry.

Keywords

Herbs, Phytochemical screening, Feed intake, Body weight, Growers

Introduction

Phytogenic feed supplements are plant based products used in animal feed to improve the growth performance and well-being of animals (Vidanarachchi *et al*., 2005; Windisch *et al*., 2007). This group of feed supplements has recently gained increasing

interest, especially for use in swine and poultry. This is mainly because of the ban on most of the antibiotic feed supplements within the European Union in 1999, with a complete ban enforced in 2006, and measures adopted to restrict their use outside the European Union because of risk for generating antibiotic resistance in pathogenic microbes (Windisch, 2007).

These phytogenic substances enhance the productivity of livestock and poultry through amelioration of feed properties, improvement of the animal's production performance, and quality of food derived from those animals. Phytobiotics represent a wide range of bioactive compounds that can be extracted from various plant sources, mainly with respect to origin and processing, such as herbs (flowering, nonwoody, and nonpersistent plants), spices (herbs with an intensive smell or taste commonly added to human food), essential oils (volatile lipophilic compounds derived by cold expression or by steam or alcohol distillation), or oleoresins (extracts derived by nonaqueous solvents). The active compounds of phytobiotics are mostly secondary plant constituents, such as terpenoids (mono- and sesquiterpenes, steroids, *etc*.), phenolics (tannins), glycosides and alkaloids (present as alcohols, alde-hydes, ketones, esters, ethers, lactones, *etc*.) (Huyghebaert *et al*., 2011). Antimicrobial activity and immunopotentiating effect are the two major properties belonging to phytobiotics which are essential for the health and well-being of the chicken (Yang *et al*., 2009; Fallah *et al*., 2013).

Hence, the present study was carried out to screen the herbs *Ocimum sanctum* (Tulsi), *Allium sativum* (Garlic), *Curcuma longa* (curcumin), *Trigonella foenum graceum* (Fenugreek) and *Zingiber officinale* (ginger) for its phytochemical constituents and to evaluate them for their effect on growth performance in growers at three different concentrations fed orally.

Materials and Methods

Experimental Site and Experimental Birds

The experiment was conducted at a private layer farm at pudhur, vaiyappamalai, Thiruchengodu taluk of Namakkal district, Tamil Nadu, India. A total of 80 grower birds Lohman breed with 20 birds per group (Grower 11 weeks) were used for the study. They were reared in cage under the normal environmental conditions with controlled feeding. Vaccination was followed as per the schedule before the initiation of the experiment.

Experimental groups

The birds were allotted into four experimental groups randomly and fed with the experimental diet for 21 days (11-14 weeks).

Collection and preparation of samples

The herbs *Ocimum sanctum* (Tulsi), *Allium sativum* (Garlic), *Zingiber* officinale (ginger), *Trigonella foenum graceum* (Fenugreek) and *Curcuma longa* (curcumin) were purchased fresh from market. Their rinds (ginger and garlic) were peeled off using knife, washed, shade dried and later ground to fine powder. 100 g of each herb was taken, blend and packed in an air tight plastic container. The taxonomic classification of the herbs is mentioned in Table 1.

Experimental diets

The feed formulation for grower is presented in the Table 2

Phytochemical screening

Phytochemical screening of the herbal preparation was carried out using standard chemical methods to identify for the presence of various chemical constituents (Trese and Evans, 1983) (Table 3).

Assessment of Growth Performance

The birds were weighed at the initiation and end of the experiment and the total feed consumption, average feed consumption, mean body weight and weight gain were assessed after 21 days. The data was collected from a sample of six birds for analysis.

Statistical analysis

The data collected on various parameters were subjected to Duncan's test as per the standard method suggested (Snedecor and cochran 1994).

Results and Discussion

The phytochemical analysis (Table 4) revealed the presence of flavanoids and volatile oils and absence of tannin, hydrolysable tannin, phenol, cardiac glycosides and vitamin C in all the herbs with flavanoids and volatile oils as the major constituent present in all. However the other phytochemical constituents that were found includes saponin, tannin, alkaloids, terpenoids, amino acid and protein, carbohydrate, phylobatanin and glycosides

The effect of the herbs on the growth performance showed no significant ($p<0.05$) difference in the initial mean body weight (g) and the final mean body weight (g) between the control and the three treatment groups. The total feed consumption (g) was significantly ($p<0.05$) higher in all the treatment groups when compared to the control with group II and III showing significantly higher ($p<0.05$) level of consumption than group I. However there is no significant difference in the mean average feed intake between the control and the treatment groups. With respect to the weight gain, group III birds gained significantly ($p<0.05$) higher weight compared to the control. However no significant difference was observed between the control and the groups I, II. Similarly no significant difference was observed between the group I and III.

Thus the effect of the herbs on growth performance with the significant increase in feed consumption (Table 5) may be justified as garlic and ginger (Demir *et al*., 2003) exhibit natural growth promoter effect and can act as potential alternatives for common artificial growth promoters like antibiotics. Additionally, garlic (*Allium sativum*) has played important dietary and medicinal roles throughout the history. Garlic is well known as a spice and herbal medicine for the prevention and treatment of a variety of diseases. It is considered as a plant with antibiotic, anticancer, antioxidant, immunomodulatory, anti-inflammatory, hypocholestrolemic effects, growth promoting, hypoglycemic and cardiovascular-protecting effects (Reuter *et al*., 1996). The aqueous extract of *Allim sativum* is known to have alkaloids, flavonoids, cardiac glycosides, terpenes, steroids and resins (Gazuwa *et al*., 2013). Ginger is the rhizome of the plant *Zingiber officinale*, consumed as a delicacy, medicine, or spice. The ethanolic and methanolic extract of zinger is known to possess alkaloid, phobotannins, flavanoids, glycosides, saponins, tannin and terpenoids and absence of steroid (Bharkava *et al.*, 2012).

Table.1 Taxonomy of the herbal preparation

Taxonomy	***Allium sativum***	***Ocimum sanctum***	***Zingiber officinale***	***Trigonella foenum-graecum***	***Curcuma longa***
Kingdom	Plantae	Plantae	Plantae	Plantae	Plantae
Class	Mognoliopsida	Mognoliopsida	Liliopsida	Mognoliopsida	Mognoliopsida
Order	Asparagales	Lamiales	Zingiberales	Fabales	Zingiberales
Family	Amaryllidaceae	Labiatae	Zingiberaceae	Fabaceae	Zingiberaceae
Genus	*Allium*	*Ocimum*	*Zingiber Mill.*	*Trigonella*	*Curcuma*
Species	*Sativum*	*sanctum*	*Zingiber officinale*	*Foenum-graecum*	*longa*

Table.2 Regular feed composition for Growers (11-14 weeks)

Ingredients	**Quantity (Kg)**
Maize	600
Pellet SF(36%) protein	150
Soya bean meal	150
Deoiled rice bran	115
Calcite	15
Dicalcium Phosphate	12
Salt	4
Soda bicarbonate	1
DL methionine	1
Lysine	0.5
Choline chloride	1
Vitamins	500 gram
Traceminerals	1 kg
Phytase	100 gram
Toxin binder	1 kg
Liver powder	500 gram

Table.3 Procedure for phytochemical analysis

S.No	**Procedure**	**Inference**
1	**Test for alkaloids** A few drops of dilute hydrochloric acid was added to small quantity of the extract and filtered **Mayer's test:** To the filtrate, few drops of Mayer's reagent was added **Dragendorff's reagent:** To the filtrate, few drops of Dragendorff's reagent was added	 Cream colour precipitate Orange brown precipitate

	Hager's test: To the filtrate, few drops of Hager's reagent was added	Yellow colour precipitate
2	**Test for saponins** To a small quantity of extract, 5ml of distilled water was added and shaked for 5 minutes	Foam remains for 2 minutes
3	**Test for tannin** 3 drops of 10% ferric chloride was added to a small quantity of extract	Blue or green colour appears
4	**Test for phenol** To a small quantity of extract, 2ml of ferric chloride was added	Dark blue colour appears
5	**Test for terpenoids** To a small quantity of extract, 2ml of chloroform and add 2ml of concentrated sulphuric acid was added along the sides of the test tube	Brown colour ring at the junction of the two liquids
6	**Test for flavonoids** To a small quantity of extract, few drops of sodium hydroxide was added. To this colour, 1ml of dilute hydrochloric acid was added along the sides of the test tube	Intense yellow colour appears Yellow colour disappears
7	**Test for Amino acid and protein** To a small quantity of extract, 1ml of Ninhydrin solution was added and heated at 50˚C for 1 minute	Violet colour appears
8	**Test for carbohydrates** **Fehling's test** To a small quantity of extract, 5ml of Fehling's solution A and B was added and heated on water bath at 50˚C for 5 minutes **Benedict's test** To a small quantity of extract 2ml of Benedict's reagent was added and heated gently	Red precipitate appears Orange red precipitate appears
9	**Test for phobatannin** To a small quantity of extract 1ml of dilute hydrochloric acid was added	Red precipitate appears
10	**Test for volatile oil** To a small quantity of extract 1ml of dilute hydrochloric acid was added	White precipitate appears
11	**Test for hydrolysable tannin** To a small quantity of extract 1ml of ammonia solution was added	An emulsion forms
12	**Test for glycosides** To a small quantity of extract 2ml of dilute sulphuric acid was added and heated at water bath at 50˚C for 2 minutes then 2ml of 10% sodium hydroxide and 5ml of Fehling's solution A and B was added	Brick red colour precipitate appears
13	**Test for Cardiac glycosides**	Formation of three layers

	To a 2ml of the extract, 2ml of glacial acetic acid was added. Then 1 drop of 10 % ferric chloride and 2ml of concentrated sulphuric acid was added along the sides of the tubes.	of different colour Upper layer-Green colour Middle layer-Brown colour Lower layer-Violet colour
14	**Test for Vitamin C** To a small quantity of extract 1ml of sodium bicarbonate solution was added	Violet colour appears

Table.4 Phytochemical analysis of the herbs

S.No	Phytochemicals	*Allium sativum*	*Zingiber officinale*	*Curcuma longa*	*Trigonella foenum-graecum*	*Ocimum sanctum*
1	Saponin	+	-	-	+	+
2	Tannin	-	-	-	-	+
3	Phenol	-	-	-	-	-
4	Alkaloid	-	+	-	+	+
5	Terpenoids	+	+	+	-	-
6	Flavanoids	+	+	+	+	+
7	Amino acid and protein	+	+	-	+	-
8	Carbohydrate	-	+	-	+	+
9	Phylobatanin	-	-	-	-	+
10	Volatile oils	+	+	+	+	+
11	Hydrolysable tannin	-	-	-	-	-
12	Glycosides	-	+	+	-	-
13	Cardiac Glycosides	-	-	-	-	-
14	Vitamin C	-	-	-	-	-

+ present, - absent

Table.5 Effect of the herbs(Mean±SE) on assessment of the growth performance in layer chicken n=6

S.No	Variables		Treatment (Mean±SE)		
		Control	Group I	Group II	Group III
1	Initial mean body weight (g)	751.67±16.07	741.67±17.27	771.67±15.64	751.67±17.47
2	Final mean body weight (g)	868.33±32.93	868.33±50.42	878.33±19.64	970.0±30.23
3	Total feed consumed/ bird(g)	970.0^{a}±30.23	751.67^{b}±16.07	1610.0^{c}±35.91	1640.0^{c}±51.12
4	Average feed intake per day/bird (g)	49.27±0.51	49.17±0.79	49.76±0.36	50.23±0.16
5	Weight gain/day/bird (g)	118.33^{ab}±31.25	126.67^{ab}±43.03	106.67^{a}±25.09	218.33^{b}±29.37

Mean values within the same row with different superscripts differ significantly ($p<0.05$)

Turmeric is a spice coming from the rhizome of *Curcuma longa*. It is used as a food coloring, but also for medicinal purposes. The active component is curcumin, a phenolic compound at concentrations of about 1 to 5%. It has antioxidant, anti-inflammatory and anti-tumoral activities. In infected chicken with *Eimeria maxima*, supplementation of feed with 1% turmeric spice improves weight gain, reduces intestinal lesions and oocyst excretion (Allen *et al*., 1998). The methanolic extract of *C. longa Linn* has tannins, alkaloids, saponins, flavonoids, terpenoids and cardiac glycosides (Rajesh *et al.*,2013). Fenugreek (*Trigonella foenum-graecum*), is an annual legume, cultivated all over the world, it is one of the herbs with multi-functional characteristics. It is a good source of dietary proteins for humans and animals. Fenugreek seeds supplementation improved significantly feed conversion ratio of broiler chickens which might be related to morphological changes in the gastrointestinal tissues (Srinivasan, 2006).

The fenugreek seeds contain lysine and L-tryptophan rich proteins, mucilaginous fibre and other rare chemical constituents such as saponins, coumarin, fenugreekine, nicotinic acid, sapogenins, phytic acid, scopoletin and trigonelline, which are thought to account for many of its presumed therapeutic effects (Mullaicharam *et al.,* 2013). It also contains many important phytochemicals like aziridine, which proved to be a potent antimicrobial agent (Vijayalakshmi *et al.*, 2011). Tulsi **(***Ocimum sanctum)* an important sacred medicinal herb from India is a well known therapeutic agent for several pathological conditions and known to possess antistress properties (Moinuddin, *et al*., 2001) and exhibits remarkable biological activities like antimicrobial, immuno-modulatory, anti - cancerous, anti oxidant, anti inflammatory, hepatoprotective and antioxidant properties (Shukla, *et al.*, 2012). It is known to contain steroidal compounds, alkaloids, tannins and absence of flavonoids (Ashish *et al*., 2013). Also our results are in accordance with the findings of Vivian and his colleagues (2015) who attributed the increased feed intake and weight gain to the presence of a protein digesting enzyme (zingibain) present in ginger which is believed to improve digestion.

From the above findings, it can be concluded that by supplementation of the herbs *Ocimum sanctum* (Tulsi), *Allium sativum* (Garlic), *Curcuma longa* (curcumin), *Trigonella foenum graceum* (Fenugreek) and *Zingiber* officinale (ginger) at 0.5% level increases the feed consumption and the weight gain in the birds with better feed utilization due to the improved digestion and healthiness of the birds favoured by the presence of phytochemical constituents and a protein digesting enzyme zingibain. However further studies are needed to assess the effect of the herbs on production performance of layers and to assess its effect on broilers so as to recommend the optimum level of feeding in poultry.

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Abbreviations:

g	-	Gram
%	-	Percentage

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