EVALUATION OF DIFFERENT MEDICINAL PLANTS AS GROWTH PROMOTERS FOR BROILER CHICKS

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ABSTRACT

This study was conducted to determine the comparative efficacy of six medicinal plants including *Nigella sativa, Boerhavia diffusa, Withania somnifera, Ipomea digitata, Azadirachta indica and Corylus avellena* @ 4 g/kg of feed as growth promoter and their subsequent influence on the performance of broilers. 210 day old chicks were randomly divided into 21 experimental units of 10 chicks each. These experimental units were randomly allotted to 7 treatments comprising of 3 replicates each. Commercially formulated broiler starter and finisher rations were offered *ad libitum* from 0-4 and 4-6 weeks of age. Authenticated samples of the plant materials were dried in shade, pulverized and mixed each @ 4g kg^{-1} of feed and offered to the chicks of the respective treatment groups. Maximum gain in weight was observed with the *Withania somnifera* (1.819 kg) followed by *Nigella sativa* (1.805 kg) and *Azadirachta indica* (1.800 kg). The best cumulative FCR at the end of 6^{th} week of age was for that of *Withania somnifera* (2.038) followed by *Nigella sativa* (2.054) and *Azadirachta indica* (2.083). The lowest results as regards FCR were recorded for *Ipomea digitata* (2.394) and *Boerhavia diffusa* (2.396). The results of the *Corylus avellena* (2.209) and control (2.235) were statistically similar. The maximum profit per bird was obtained from *Azadirachta indica* treated birds followed by *Nigella sativa* and *Withania somnifera* treated chickens as compared to control. It was concluded from this study that medicinal plants especially *Withania somnifera, Nigella sativa* and *Azadirachta indica* can be used as growth promoters in the poultry diets with better production performance.

Key words: Broilers, Medicinal Plants, Growth Promoter, Production Performance

INTRODUCTION

The use of intricate intensive poultry production systems have led to marked increase in the production of poultry meat and eggs throughout the world (Armstrong, 1986). It has triggered the discovery and widespread use of a number of "feed additives". The term feed additive is applied in a broad sense, to all products other than those commonly called feedstuffs, which could be added to the ration with the purpose of obtaining some special effects (Feltwell and Fox, 1979). The main objective of adding feed additives is to boost animal performance by increasing their growth rate, better feed conversion efficiency, greater livability and lowered mortality in poultry birds. These feed additives are termed as "growth promoters" and often called as non-nutrient feed additives (Singh and Panda, 1992).

A study of drug resistance on *E. coli* from colisepticaemia cases in Pakistan has indicated a high resistance to common antibiotics used in routine as growth promoters. The number of *E. coli* resistant isolates against penicillin was 69.31%, against streptomycin 12.70%, for oxytetracyclin 73.33% and for furazolidone 7.7%. Similarly, 55% isolates of *pasteurella multocida* were resistant against tetracycline.

As regards the resistance to antibiotics and therapeutic levels, a large percentage of resistant isolates of different microbial species have been observed. Moreover, at least three *E. coli* isolates were found completely resistant to quinolones (Qureshi, 1998). In June 1999, throughout European Union the feed manufacturers have been directed not to include virginiamycin, spiramycin, tylosin phosphate and zinc bacitracin at sub-therapeutic levels as growth promoters in animal feeds because of the risk of possible drug resistance in humans incomplete sentence?. As a result, the feed industry has adopted a new trend of so called "all natural" feed additives that are the products of modern science, but have their origin in traditional or even ancient traditional medicine.

Medicinal plants have been used since centuries to treat various diseases in man and animals. It is not surprising, therefore, that several herbal agents have been empirically used in poultry birds and other animals. Many herbs have a long history of their use even prehistory, in preventing or treating human and animal illnesses. However, even a single medicinal plant or herb consists of many bioactive chemical compounds and may act as a diuretic (Vohra and Khan, 1981), as an anthelmentic (Al-Khalil, 1995),

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as an appetizer (Al-Yahya, 1986), alkaline phosphatase stimulator (Eskander *et al.*, 1995), antibacterial (Desta, 1993) and antifungal factors (Rathee *et al.*, 1982).

Withania somnifera showed positive antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*, *Salmonella* spp., *Pseudomonas aeruginosa* and *Candida albicans* (Al-Meshal *et al*., 1982). Chatterjee and Pakrashi (1991a) reported that roots of *Boerhavia diffusa* have been considered expectorant, diuretic and laxative; useful in treatment of oedema, jaundice, ascites, gonorrhoea and other internal inflammations. Chatterjee and Pakrashi (1991b) stated that seeds of *Nigella sativa* are diuretic, lactiferous and stimulate uterine contraction.

Thus herbs could be expected to serve as safer alternatives as growth promoters due to their suitability and preference, lower cost of production, reduced risk of toxicity, minimum health hazards and environment friendliness (Devegowda, 1996). Recently field trials on certain herbal formulations as growth promoters in India, Greece, UK and USA, have shown encouraging results as regards weight gain, feed efficiency, lowered mortality and increased livability in poultry birds (Kumar, 1991; Babu *et al*., 1992; Mishra and Singh, 2000; Deepak *et al*., 2002).

Due to increasing resistance to antibiotics even of feed grade European Union imposed ban on use of such growth promoters which has prompted the search for alternate feed supplements. One such alternative could be the use of medicinal plants /herbs. They are used for their medicinal, aromatic or flavoring properties since ancient times in different civilizations.

The recent ban on the use of antimicrobial feed additives in the United Kingdom has high lighted the necessity and importance of such medicinal plants/herbs as feed additive in poultry. Therefore the present study was carried out with the objective to evaluate the growth promoting efficacy of some indigenous medicinal plants and their influence on the broiler performance.

MATERIALS AND METHODS

Experimental Birds

210 day-old Hubbard chicks were randomly divided into 21 experimental units of 10 chicks each. These experimental units were randomly allotted to 7 treatments comprising of 3 replicates each (10 chicks in each experimental unit).

Housing of Birds

Chicks were raised in a room having 36 pens measuring (3 ft x 4 ft x 1.75 ft) were allotted at random to different experimental units. A layer of three inches saw dust was used as a litter material which was stirred regularly during the experiment to keep it in appropriate condition. The brooding temperature was maintained at 35^{o}C during 1st week. It was then gradually lowered by 3^{o}C every week until it reached to room temperature (i.e. 25±1^{o}C). Mean initial weight of the chicks was 37.85 g at the start of experiment and the chicks were wing tagged.

Commercially formulated broiler starter and finisher rations were offered *ad libitum* from 0-4 and 4-6 weeks of age. Samples of medicinal plants were dried in shade, pulverized and mixed each @ 4g kg^{-1} of feed and offered to the chicks of the respective treatment groups.

Vaccination

Newcastle disease vaccination: Intraocular at 7th day and subcutaneously at 22nd day. Infectious Bursal Disease vaccination: on 11th day and 28th days in drinking water.

Data regarding feed intake, LW was recorded on weekly basis and mortality if any was recorded accordingly. Weight gain was calculated on weekly basis by subtracting weight of the respective week from the last week weight. FCR was calculated by dividing the feed intake by weight gain. Economics was calculated at the completion of the experiment by difference of all the expenses and the income earned at completion of experiment. The experiment was conducted according to complete randomized design. The data thus collected were subjected to statistical analysis by using Analysis of Variance Technique and in case of parameters showing significant treatment effect, comparison of mean values were further compared by Duncan's Multiple Range Test (Snedecor and Cochran, 1991).

RESULTS AND DISCUSSION

Feed Intake and Weight gain

Feed intake of birds at 4 weeks of age in broilers exhibited non significant differences as shown in Table 2. Feed intake at 6 weeks was maximum in treatment No.5 *Azadirachta indica* (3.750 kg) followed by treatment No.1 *Nigella sativa* (3.707 kg), treatment No.6 *Withania somnifera* (3.707 kg), treatment No.3 *Corylus avellena* (3.634 kg), control (3.435 kg), treatment No.4 *Ipomea digitata* (3.418 kg) and treatment No.2 *Boerhavia diffusa* (3.393 kg), respectively. However, non significant (P>0.05) differences were found between treatment No.1 and 6

yes as recorded. The feed intake was 7.9, 5.8, 9.2 and 7.9% more in T No.1, T No.3, T No.5, and T No.6 than the control (T No. 7) as shown in Table 2. Feed conversion efficiency of broilers supplemented with medicinal plants showed best values at 4th week for treatment No.6 (1.516), treatment No.1 (1.532) and treatment No.5 (1.559) as compared to the rest of the treatments. While highest value for FCR was observed in *Ipomea digitata* (1.695). The broilers exhibited best FCR at 6th week for *Withania somnifera* (2.038) followed by *Nigella sativa* (2.054) and *Azadirachta indica* (2.083) as given in Table 3. There were no statistical differences (P>0.05) among these three treatments but these were statistically different from rest of the treatments. The lowest FCR results were recorded for *Boerhavia diffusa* (2.396) and *Ipomea digitata* (2.394). Feed intake gradually increased with change in weeks and in response live weight increased showing maximum values for T6, T1 and T5 while minimum values for live weight were recorded for T2 followed by T4 and T7, respectively.

The differences in weight gain were non significant during 1st and 2nd week (p>0.05). However, at 4th week of age, there was significant (p< 0.05) effect of treatments on weight gain. The maximum weight gain was observed in the treatment No.6 (*Withania somnifera*), treatment No.1 (*Nigella sativa*) and treatment No.5 (*Azadirachta indica*) as compared to treatment No.3 (*Corylus avellana*)), treatment No.7 (control), treatment No.2 (*Boerhavia diffusa*) and treatment No. 4 (*Ipomea digitata*). However, the differences among treatment 6 (*Withania somnifera*), 1 (*Nigella sativa*) and 5 (*Azadirachta indica*) were non significant. Mean weight gain was less in treatment No.3 (*Corylus avellana*), 7 (untreated control), 2 (*Boerhavia diffusa*) and 4 (*Ipomea digitata*) as shown in Table 1. The results showed maximum weight gain at 6 weeks age in treatment No.6 *Withania somnifera* (1.819 kg) followed by Treatment No.1 *Nigella sativa* (1.805 kg), Treatment No.5 *Azadirachta indica* (1.800 kg), Treatment No.3 *Corylus avellena* (1.645 kg), Treatment No.7 control (1.537 kg), Treatment No.4 *Ipomea digitata* (1.428 kg) and Treatment No.2 *Boerhavia diffusa* (1.416 kg) as given in Table-1. Treatment No.1, 3, 5 and 6 achieved 17.4, 7.0, 17.1 and 18.3 % higher weight gain, respectively as compared to control.

The results of present study are in agreement with Osman and Barody (1999) who observed increase in weight gain, feed intake and feed conversion ratio with *Nigella sativa* seeds when added to the broiler feed. This weight gain increase in *Nigella sativa* fed birds was probably due to its amino acid contents as reported by Babayan *et al.* (1978) who stated that *Nigella sativa* seeds contain almost all essential amino acids required for maximum growth of birds, i.e.; lysine (7.62%), arginine (19.52%), phenylalanine (7.93%), methionine (6.16%), threonine (1.23%), leucine (10.88%) and isoleucine (4.03%). They further found that *Nigella sativa* seeds also contain reasonable amount of non-essential amino acids required for the poultry i.e. alanine (3.77%), aspartic acid (5.02%), glutamic acid (13.21%), proline (5.34%) and serine (1.98%). Similarly, semi-essential aminoacids for birds glycine (4.17%) and tyrosine (6.08%) were also observed by Babayan *et al*. (1978). Moreover, Kudryashova and Kolobkova (1953) have reported the presence of cystine, lysine, alanine, aspartic acid in the *Nigella sativa* seeds. Weight gain is also favoured due to the presence of essential fatty acids i.e. linoleic acid 56.12%, linolenic acid 0.70% in *Nigella sativa* (Tiwari and Singh, 1942; Gad *et al.,* 1963) because the deficiency of these essential fatty acids results in growth reduction (Ensminger, 1980). The birds offered *Withania somnifera* ranked first as regards weight gain. Our results are in accordance with those of Pradhan (1995) who evaluated "StressRoak" an herbal product (containing *Withania somnifera* also) as growth promoter on the performance of broilers and observed marked increase in performance as compared to control. Said (1996b) has reported that roots of *Withania somnifera* are extensively used in all cases of general debility, emaciation (of children) senile debility, nervous exhaustion, loss of memory and muscular energy. It imparts energy and vigour to the body against diseases or from over work and thus prevents premature aging. Devegowda (1996) while working on medicinal plants in poultry have established antistress, adaptogenic and immunomodulatory properties of *Withania somnifera* which helps the birds to perform better than control. Chopra *et al*. (1956) have also mentioned that roots of *Withania somnifera* have been used to treat debility due to old age and emaciation in children.

Babbar *et al.* (1982) while evaluating plants for antiviral activity have reported that *Withania somnifera* is active against Rani Khet virus. Its antibacterial activity against *Escherichia coli, Salmonella and Staphylococcus aureus* suggested that it could be one of the best alternatives to synthetic antibiotic growth promoters that are banned in the world (Al-Meshal *et al.* 1982). Bhattacharya *et al.* (1987) while performing experiments, on mouse have observed antistress activity of *Withania somnifera* roots. Similar results were recorded by Singh *et al.* (1982) who have claimed that *Withania somnifera* is a rejuvenating herbal drug which

enhances survival during stress. These findings duly supported the growth promoting activity of these plants tested in the present study.

The performance of birds fed *Azadirachta indica* (Neem) showed significantly better performance as compared to the rest of treatments. These results coincide with those of Chakravarty and Prasad (1991) who achieved highest body weight gain and best feed conversion ratio as compared to control when offered Neem leaf extract to broilers from 1 to 6 weeks. Koul *et al*. (1990) have also reported that neem extract suppresses pathogenic bacteria including *Staphyloccoccus aureus, Mycobacteria*, *Salmonella paratyphi* and *Klebsiella pneumoniae*.

The increase in weight gain could be possibly due to the presence of macro minerals i.e. Potassium (19), Magnesium (0.09), Phosphorous (0.09) and micro minerals such as iron (0.296), Copper (0.01), Manganese (0.037) and Zinc (0.03) on dry weight basis in *Azadirachta indica* as reported by Sondhi and Agarwal (1995). The deficiency of these macro and micro-minerals results in anorexia, osteoporosis and retarded growth in birds (Ensminger, 1980). Findings of this study are favored by Chopra (1933) who has reported that its water extract acts as tonic in human adults and removes general debility (Radwanski and Wickens, 1981). *Azadirachta indica* has been claimed to relieve many different pains, fevers and infections and is said to be the "Village Pharmacy" (Vietmeyer, 1992).

Antibacterial activity of *Azadirachta indica* suppresses pathogenic bacteria including *Staphylococcus aureus, Mycobacteria, Salmonella paratyphi* and *Klebsiella pneumoniae* and resulted in enhanced growth of birds (Koul *et al*., 1990). Thus *Azadirachta indica* medicinal plant might substitute the existing antibiotic growth promoters. The virus inhibiting activities of Neem in Rani Khet disease both *in vitro* and *in vivo* (Koul *et al.,* 1990) and Pox virus (Rai and Sethi, 1972) have also helped in the better performance of neem fed birds. Watt (1972) and Kirtikar and Basu (1984) have reported that *Azadirachta indica* is useful in treating general debility in human patients.

Mortality

Overall morality rate in broilers subjected to different treatments was 5.2 %. However, maximum mortality was recorded in birds fed *Corylus avellana* and *Ipomea digitata* (1.42%) followed by control (0.95%) and *Boerhavia diffusa*, *Azadirachta indica* and *Withania somnifera* (0.47% each). Maximum mortality was noticed in 4th week followed by 2nd week and 1st week.

The results of this study revealed lowest mortality rate in *Azadirachta indica* treated birds which might be due to antimicrobial activities of *Azadirachta indica* which suppresses the pathogenic bacteria including *Staphyloccoccus aureus, Mycobacteria*, *Salmonella paratyphi* and *Klebsiella pneumoniae* as reported by (Koul *et al*., 1990).

Economic Evaluation

The economics evaluation showed maximum profit per bird in *Withania somnifera* (Rs.21.44), *Nigella sativa* (Rs.20.60), *Azadirachta indica* (Rs.20.38) as compared to control as shown in Table 5. Thus, broilers in T6, T1 and T5 earned significantly more profit than T3 followed by T7, T4 and T2.

The economic evaluation of present study revealed maximum net profit per bird in *Withania somnifera*, *Nigella sativa* and *Azadirachta indica* treated birds. The results of present study are supported by Narahari (1995) and Prajapati (1997) who reported extra profit/bird by using medicinal plants as growth promoter in broilers.

CONCLUSION AND RECOMMENDATIONS

The results of present study revealed that medicinal plants/herbs especially *Withania somnifera*, *Nigella sativa* and *Azadirachta indica* can be used as growth promoters in the poultry diets with better production performance.

Table I ***Medicinal plants tested in the trial***

Treatments	Name of Plant	Local Name	Family	Parts used
1	*Nigella sativa*	Kalonji	Ranunculaceae	Seeds
2	*Boerhavia diffusa*	Baskhapra	Nyctaginaceae	Whole Plant
3	*Withania somnifera*	Asgand	Solanaceae	Roots
4	*Ipomea digitata*	Bidari Qand	Convulaceae	Roots
5	*Azadirachta indica*	Neem	Meliaceae	Leaves
6	*Corylus avellana*	Funduq	Betulaceae	Fruits
7	Untreated control			

Table II ***Effect of different medicinal plants on feed intake (kg) in broilers***

Treatment No.	Plant Species	Weeks						%Increase/ Decrease Over Control
		1	2	3	4	5	6	
1	*Nigella sativa*	0.075	0.334	0.874	1.610	2.420^{b}	3.707^{ab}	+7.9
2	*Boerhavia diffusa*	0.073	0.327	0.859	1.517	2.658^{a}	3.393^{c}	-1.2
3	*Corylus avellena*	0.075	0.327	0.874	1.587	2.555^{ab}	3.634^{abc}	+5.8
4	*Ipomea digitata*	0.074	0.326	0.861	1.524	2.693^{a}	3.418^{bc}	-0.5
5	*Azadirachta indica*	0.076	0.332	0.873	1.620	2.416^{b}	3.750^{a}	+9.2
6	*Withania somnifera*	0.078	0.343	0.881	1.601	2.417^{b}	3.707^{ab}	+7.9
7	*Control*	0.077	0.328	0.884	1.586	2.641^{a}	3.435^{bc}	
	Pooled S.E.	0.0007	0.0029	0.0038	0.0158	0.0305	0.0428	

^{abc}Means in a column showing the same letters are not significantly different (P<0.05)

Table III ***Effect of different medicinal plants on weight gain (kg) in broilers***

Treatment	Plant Species	Weeks						%Increase/ Decrease Over Control
		1	2	3	4	5	6	
1	*Nigella sativa*	0.078	0.310	0.683^{ab}	1.051^{a}	1.411^{a}	1.805^{a}	+17.4
2	*Boerhavia diffusa*	0.076	0.299	0.633^{c}	0.900^{b}	1.236^{d}	1.416^{d}	-7.9
3	*Corylus avellena*	0.077	0.302	0.658^{bc}	0.949^{b}	1.332^{c}	1.645^{b}	+7.0
4	*Ipomea digitata*	0.076	0.299	0.635^{c}	0.899^{b}	1.253^{d}	1.428^{d}	-6.1
5	*Azadirachta indica*	0.071	0.308	0.663^{abc}	1.039^{a}	1.385^{ab}	1.800^{a}	+17.1
6	*Withania somnifera*	0.081	0.319	0.704^{a}	1.056^{a}	1.421^{a}	1.819^{a}	+18.3
7	*Control*	0.079	0.300	0.659^{bc}	0.945^{b}	1.345^{bc}	1.537^{c}	
	Pooled S.E.	0.0007	0.0025	0.0066	0.0161	0.0158	0.0376	

^{abcd}Means in a column showing the same letters are not significantly different (P<0.05)

Table IV ***Effect of different medicinal plants on feed conversion ratio of broilers***

Treatment No.	Plant Species	Weeks					
		1	2	3	4	5	6
1	*Nigella sativa*	0.972	1.077	1.280^{bc}	1.532^{b}	1.715^{c}	2.054^{c}
2	*Boerhavia diffusa*	0.974	1.094	1.357^{a}	1.686^{a}	2.150^{a}	2.396^{a}
3	*Corylus avellena*	0.978	1.083	1.328^{ab}	1.672^{a}	1.918^{b}	2.209^{b}
4	*Ipomea digitata*	0.978	1.090	1.356^{a}	1.695^{a}	2.149^{a}	2.394^{a}
5	*Azadirachta indica*	0.974	1.078	1.317^{abc}	1.559^{b}	1.744^{c}	2.083^{c}
6	*Withania somnifera*	0.970	1.075	1.251^{c}	1.516^{b}	1.701^{c}	2.038^{c}
7	*Control*	0.975	1.093	1.341^{ab}	1.678^{a}	1.964^{b}	2.235^{b}
	Pooled S.E	0.0032	0.0062	0.0109	0.0199	0.0415	0.0335

^{abc}Means in a column showing the same letters are not significantly different (P<0.05) check

Table V ***Effect of different medicinal plants on economics (rupees) of the broilers***

Treatment No.	Plant Species	Cost /bird				Income	Profit / bird
		Plants	Feed	Miscellaneous	Total	Sale of birds	
1	*Nigella sativa*	0.80	51.89	35.00	87.69^{a}	108.30	20.60^{a}
2	*Boerhavia diffusa*	0.16	47.50	35.00	82.66^{b}	84.96	2.29^{d}
3	*Corylus avellena*	1.00	47.09	35.00	83.09^{b}	98.70	15.60^{b}
4	*Ipomea digitata*	0.40	47.85	35.00	83.25^{b}	85.68	2.43^{d}
5	*Azadirachta indica*	0.12	52.50	35.00	87.6^{a}	108.00	20.38^{a}
6	*Withania somnifera*	0.80	51.89	35.00	87.69^{a}	109.14	21.44^{a}
7	*Control*	0.00	48.09	35.00	83.09^{b}	92.22	9.13^{c}

^{abcd}Means in a column showing the same letters are not significantly different (P<0.05)

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