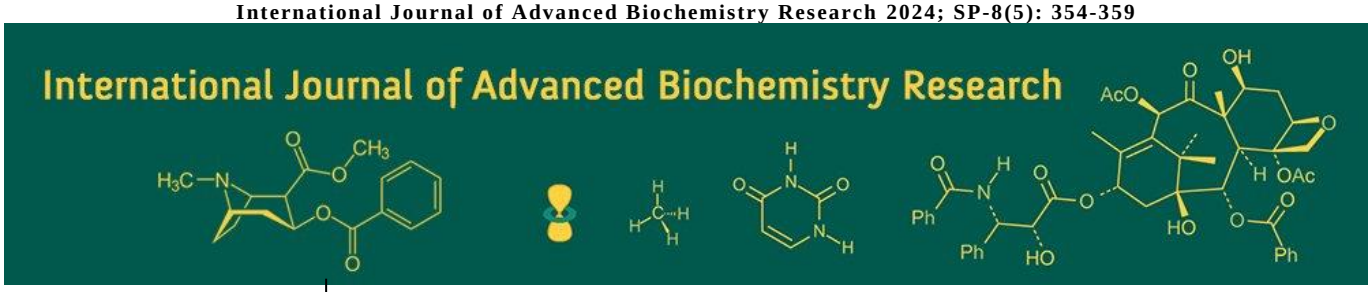

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Effect of supplementing with neem and Tulsi powder on broiler body weight and gain weight in a deep litter system

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Abstract
Experiment was conducted on a total of 48 chicks from day old to four weeks of age to "Effect of varying Neem and Tulsi supplementation on the body weight and Gain in weight of Broilers in a Deep Litter System" 48-day old chicks were randomly divided into four groups with three sub groups of 4 chicks in each. Control (first) group received standard broilers diet. Chicks in, second, third, and fourth received standard broilers diet supplemented mix with Neem & Tulsi as 5 gram/kg feed respectively. Results revealed that there was a significant effect of different level of Neem & Tulsi supplementation performance, on body weight and gain in weight of broiler. feed supplemented with Neem & Tulsi. T_3 i.e., Neem (*Azadirachta indica*) and Tulsi (*Ocimum sanctum*) @ 5 gm/Kg Feed was found to be best compared to all treatments.

Keywords: Broilers, neem, tulsi, growth performance and feed efficiency

Introduction
In India, both intensive and traditional systems of poultry farming are followed, but intensive system is rapidly increasing due to increasing land and other input costs. It is estimated that in India, about 60% of poultry meat and 56% of eggs are currently being produced in the intensive system. It is further estimated that there are about 60000 farms under Intensive system (some of them having more than 100000 birds) while there are about 100000 small farms scattered in rural areas practicing more extensive production systems, having lock sizes ranging from 25 to 250 birds. In case of layers the cage system is rapidly replacing the deep litter system. However, in broiler farming, the deep litter system is more prevalent.
The average composition of the poultry products reveals a considerable wealth of proteins of high biological value, in the proportions of 13.4% in eggs, and 14% in the meat. The hen egg contains 10.4% lipids and 2.1% minerals as well as the vitamin A. In addition to the excellent dressing percentage of 65%; poultry meat has the excellent nutritional and dietetic qualities (low fat content, with the present fats being rich in polyunsaturated fatty-acids Opie *et al.* (2017) [24].
In order to protects chicken from various diseases, and enhance growth of chicks the farmers use the antibiotics and steroids, these products in meat when consumed by human beings have residual effect causes health risk or cancer due to easily pass from chicken meat to human. Hence use of them in animal feeding is being discouraged by WHO. Therefore, farmers are trying to switch back to tradition method by using herbal substance. To promote growth in a similar manner without leaving any harmful effects on human health behind.
Recently WHO (2003) [34] recommended a global alliance on traditional medicine a developed a guideline for the quality control of herbal drugs. Introduction of several medicinal plants used in Indian traditional medicine have attractive many scientists. Some of those plants have also been listed as immunomodulatory agent. These plants include *Allium sativum* (lashsun), Aloe vera (*Ghritkumari*) *asparagus racemose*, *azadirachita indica* (Neem) *Ocimum sanctum* (Tulsi) and *withiania sominifera* (ashwagandha)
A lot of people, of many faiths, enjoy eating broiler meat since it is inexpensive and nutritious.

Farmers are employing antibiotics as growth promoters or life savers for poultry due to a lack of knowledge about broiler farming. This results in every broiler serving as a reservoir for antibiotics. Consumption of these broilers by humans exposes them to the potential health risks associated with the medication residues they carry Kibria and Verma (2009) [20]. The risk of the presence of antibiotic residues in milk and meat and their harmful effects on human health has led to their prohibition for use in animal feed in the European Union. Prohibition of most of antimicrobial growth promoter, plant extracts have gained interest in animal feed strategies Charis (2000) [8].

Poultry feed was supplemented with sub-therapeutic antibiotics with an aim to modify the intestinal Microbiota. Unfortunately, the spread of antibiotic-resistant bacteria led the European Union (EU) to ban the use of antibiotics as growth promoters (AGPs) in poultry and animals in 2006. Due to the restriction in the EU and other countries, natural and safe replacements to AGPs have been sought Amad *et al.*, (2011) [4].

Antibiotic growth promoters (AGP) have been used as a feed additive in poultry industry to enhance gut health and to control sub-clinical diseases. With increasing public concerns about bacterial resistance to antibiotics, the use of antibiotics in therapeutic or sub therapeutic doses in poultry feed has been severely limited or eliminated in many countries. European Union has preventively banned the use of antibiotics as growth promoters since 1st January 2006 Catala-Gregori *et al*., (2008) [7]. Accordingly, options other than AGP should be suggested to livestock producers so that animal health, productivity, and carcass quality can be preserved. The efficiency of antibiotics in poultry and livestock production resulted in extensive use of these synthetic substances. However, low doses as growth promoters (AGPs) resulted in increased microbial resistance to antibiotics Rochfort *et al.*, (2008) [28]. Developed countries banned the use of AGPs in poultry and livestock in the early 2000s. However, this resulted in the re-emergence of infections with harmful effects on animal performance. This led to a search for alternatives to antibiotics Gheisar & Kim, (2018) [12].

The neem tree *Azadirachta indica* from the family Meliaceae Von Maydell (1986) [33] contains azadirachtin- a biologically active compound found in its seeds, bark and leaves which is responsible for its varied medicinal uses. Besides, it is known to induce some toxic effects; neem preparations fed to laying hens have been reported by Sadre *et al*., (1984) [30] and Gowda *et al*., (1998) [14] to significantly reduce the content of haemoglobin, erythrocyte count and packed cell volume.

Ocimum sanctum (OS) is commonly known as Tulsi, reputed medicinal plant has recently been shown to possess very interesting pharmacological properties such as anti – inflammatory Agarwal *et al*., (1999) [1], Antioxidant Devi (2001) [10] and anti-stress properties Sood *et al*., (2006) [31]. A decoction of Tulsi leaves is a popular remedy for cold Pandey *et al.* (1990) [25] and Anita *et al*., (1990) [5].

Isolated from the leaves of Tulsi are the biologically active chemicals ursolic acid, apigenin, and luteolin, all of which stimulate the cell-mediated immune response and prime the body for a more effective response to future challenges from disease organisms. The immunological responses of immunocompromised birds, when fed Tulsi leaves, are both humoral and cell-mediated. Devakumar and Sukett *et al.*, (1993) [9] found that even a small amount of Tulsi leaf extract inhibited the growth of a variety of bacteria and yeasts. There has been some preliminary investigation on the use of Tulsi leaves as a growth booster in broiler production (Hasan *et al.*, 2016) [16], but more work is needed to make this a reality in the real world.

The ginger plant, or *Zingiber officinale*, lives for multiple years. It is speculated that ginger's fragrant, carminative, and absorbent qualities account for its effectiveness a study by Govindarajan and Connell (1983) [13]. Detoxification, anti-diabetic, and antiemitic properties have also been attributed to ginger (Egwurugwu *et al.*, 2007; Al-amin *et al.*, 2006) [11, 3]. In recent years, researchers have examined the potential of plant extracts as a natural antibacterial. Tulsi and neem extract used as a herbal growth booster in broiler production is shown to be cost-effective and safe Khatun *et al*. (2013); Prasannabalaji *et al.* (2012) [19, 27].

Use of herbs and other medicinal plants as chicken feed additives According to Ahmad *et al*. (2005) [2] Neem (*Azadirachta indica*) and Tulsi (*Ocimum sanctum*) plants are native to the Asian subcontinent, and their therapeutic virtues have been known for thousands of years. Due to their great variety of beneficial medical characteristics, including those that are effective against bacteria, viruses, fungi, protozoa, and other parasites while posing no threat to human health, Neem and Tulsi have gained widespread attention around the world. Source: Kale *et al.*, 2003 [18]. Sadekar *et al.* (1998) [29] found that when immunosuppressed birds ate Neem and Tulsi leaves, their humoral and cell-mediated immune responses improved. You may read about how these herbs have been used to treat conditions like bronchitis, rheumatism, and fever in Indian Materia Medica Nadkarni (1984) [23].

Tulsi (*Ocimum sanctum*) is part of such plants, considered to be the “Queen of herbs” due to its medicinal properties. Tulsi is considered the maximum sacred herb throughout the India and Ayurveda has properly described the use of Tulsi as an aromatic herb, belonging to the Labiateae family. In Sanskrit, “Tulsi” means “incomparable” and the entire plant is used as a remedy source Bansod and Rai (2008) [6].

The plant is pronounced to possess anti-infertility, anticancer, antibacterial Joshi and Parle (2006) [17], antidiabetic, antifungal, antimicrobial, hepatoprotective, cardioprotective, antiemetic, antioxidant Subramanian *et al*., (2005) [35], antispasmodic, analgesic, anti-ulcerogenic and ulcer healing houses, adaptogenic Kumar and Batra (2022) [21] and diaphoretic movements Mondal *et al*., (2009) [22]. Bioactive substances such eugenol, ascorbic acid, beta-carotene, beta-sitosterol, palmitic acid, and tannins are responsible for these effects. Source: Gupta *et al*., (2008) [15]. By scavenging free radicals, Tulsi leaf powder added to diet significantly reduced lipid peroxidation Authors Prajapat *et al*., (2018) [26].

Neem and Tulsi are some of the important native herbs that can be used in poultry diets. These herbs are not only cheaper sources of feed but also have broad medicinal properties like antiprotozoal, hepato-protective, antimicrobial (antiviral, antibacterial, antifungal) and many other properties having not any serious adverse effects and has attracted worldwide eminence. However, there is no concrete information about using Neem and Tulsi in quail diet and their possible effects on health and performance of the quails.

Materials and Methods

The current experiment entitled "Effect of varying Neem and Tulsi supplementation on the body weight and Gain in weight of Broilers in a Deep Litter System" was done in Broilers Production unit, of Department of Animal Husbandry and Dairying, SHUATS, Prayagraj, India. The impact of this examination was assessed as far as exhibitions *viz*, development, Body weight and Gain in weight proportion of broilers.

Distribution of Broilers

The trial initiated on November 11th 2022 and proceeded till for the time of four weeks. An allout no. of multi day-old broiler chicks which were partitioned arbitrarily into four gatherings with three sub bunches including four chicks. Chicks were taken care of starter ration up to 3weeks age (1 to 21days) and afterward broiler finisher ration 3-4 weeks age (22-28days).

Table 1: Details of dietary treatments:

Group	Dietary Treatments
T_0 (Control)	Basal Diet
T_1	Basal Diet + Neem (*Azadirachta indica*) @ 5 gm per Kg Feed
T_2	Basal Diet + Tulsi (*Ocimum sanctum*) @ 5 gm per Kg Feed
T_3	Basal Diet + Neem (*Azadirachta indica*) and Tulsi (*Ocimum sanctum*) mixed at 1:1 @ 5 gm per Kg Feed

Collections and preparations of ingredients

The essential Neem leaf powder (*Azadirachta indica*) and Tulsi leaf powder (*Ocimum sanctum)* taken from the local market, Prayagraj, and the both combination of Neem leaf powder (*Azadirachta indica*) and Tulsi leaf powder (*Ocimum sanctum)* taken separately with the ratio of 1:1 each 5 gm of powder has mixed with 1kg of poultry feed. The ration was supplemented as per dietary regimes of treatment. Broiler starter ration contained CP 22% and ME:2900kcl and broiler finisher ration contained CP 19%, ME:3000kcl was fed ad libitum to the birds.

Results And Discussion

Body Weight of Broilers

The data regarding the body weight of broiler chicks from day old to four weeks of age are presented in table 2 to 3.

Body weight of (0) day chicks (g)

The data regarding body weight of day-old chicks randomly distributed into control (T_0) three different treatments (T_1, T_2 and T_3) are presented in Table 2. The analysis of variance (ANOVA) of the same is given in the Table 3. The following observations were made:

In general, the body weight of day-old chicks ranged from 44.10-51.30 g.

The body weight of day-old chicks in control (T_0) and three treatments *viz*. T_1, T_2 and T_3 ranged from 45.20-51.30, 44.10-49.44, 45.27-48 and 46.04-49.75 g, respectively.

The mean body weight of day-old chicks in different treatments *viz*. T_0, T_1, T_2 and T_3 was 48.83, 45.94, 46.39 and 48.16 g, respectively.

The differences in the body weight of day chicks in different treatments were found to be non-significant (Table 3).

From the perusal of data on body weight of day-old chicks randomly distributed in different treatments contained in Table 2, it was noted that irrespective of treatments the body weight of chicks in general ranged from 44.10-51.30 g. The highest mean body weight of chicks was recorded in T_0 (48.83) followed by T_3 (48.16), T_2 (46.39) and T_1 (45.94). The differences in these values between the treatments were found non-significant. It indicated that the random distribution of the chicks among the different groups of treatments of the trial was proper and unbiased.

Table 2: Average body weight (g) of day-old broiler chicks in different treatments.

Replication	Treatments				
	T_0	T_1	T_2	T_3	Mean
R_1	49.50	46.00	45.27	48.30	47.26
R_2	45.20	44.25	48.00	48.20	46.41
R_3	49.33	44.10	46.30	46.40	46.53
R_4	51.30	49.44	46.00	49.75	49.12
Mean	48.83	45.94	46.39	48.16	

Table 3: Analysis of variances (ANOVA) for the data on body weight of day-old broiler chicks contained in Table 2.

Anova					
Source of Variation	SS	Df	MS	F	F tab
Replication	18.7788	3	6.25962	1.9197	3.86
Treatment	22.9628	3	7.65429	2.3474	3.86
Error	29.3464	9	3.2607		
Total	71.08817	15			

Average weekly body weight of broilers

The data regarding body weight of broilers of different treatments are shown in Table 5 and ANOVA of the same is given in Table 6 The following observations were made;

At first week of age the highest body weight of broilers was recorded in T_2 (174.87 g), followed by T_3 (166.55 g), T_1 (166.50 g) and T_0 (152.50 g), respectively.

At second weeks of age the highest body weight of broilers was recorded in T_2 (436.14 g) followed by T_0 (433.33 g), T_3 (432.84 g) and T_1 (408.08 g), respectively.

At third weeks of age the highest body weight of broilers was recorded in T_2 (910.88 g), followed by T_3 (892.28 g), T_0 (834.08 g) and T_1 (801.09 g), respectively.

At fourth weeks of age the highest body weight of broilers was recorded in T_3 (1595.02 g) followed by T_2 (1568.12 g), T_1 (1504.85 g), T_0 (1457.69 g) and respectively.

Irrespective of treatments the mean body weight of broilers in T_0, T_1, T_2 and T_3 week of age was 719.4 g, 720.13 g, 772.50 g, 771.67 g. respectively.

Irrespective of weeks the mean body weight of broilers in first, second, third, fourth was 164.62 g, 427.59 g, 859.58 g and 1531.42 g, respectively.

The differences in the mean body weight of broilers, the treatments were found significant. From the perusal of data on weekly body weight of broilers, contained in Table 5, it may be noted that mean body weight of broilers, irrespective of weeks at one, two, three, four weeks of age was 164.62 g, 427.59 g, 859.58 g, and 1531.42 g, respectively. The differences in these were significant, which indicate a significant effect of age on weekly body weight of broilers in all treatments. These results were expected. Regarding the influence of treatments on weekly body weight of broiler was noted that mean body weight of different treatments were recorded T_2 (772.50 g) and followed by, T_3 (771.67 g), T_1 (720.13 g) and T_0 (719.4 g). The differences in these values were found to be significant, indicating thereby a significant effect of day-old chicks on body weight of broilers chicks.

Table 4: Average weekly body weight (g) of broilers in different treatments.

Treatments	W1	W2	W3	W4	Mean
T_0	152.50	433.33	834.08	1457.69	719.4
T_1	166.50	408.08	801.09	1504.85	720.13
T_2	174.87	436.14	910.88	1568.12	772.50
T_3	166.55	432.84	892.28	1595.02	771.67
Mean	164.62	427.59	859.58	1531.42	

Table 5: Analysis of variance for the data on weekly body weight (g).

ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**F tab**	**CD at (5%)**
Treatment	10953	3	3651.007	3.600	3.86	50.93
Weeks	42744	3	1424806	1405.17	3.86	
Error	9125.7	9	1013.972			
Total	42944	15				

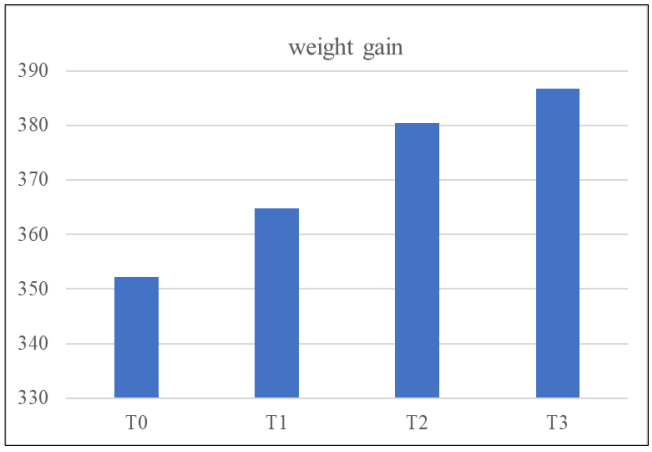

Fig 1: Average weekly body weight (g) of broiler

Average weekly body gain in weight of broilers in different treatment (g)

The data regarding average weekly gain in weight per broilers randomly distributed into four different treatments (T_0, T_1, T_2 and T_3) are presented in the Table 7 and ANOVA of the same is given in Table 8. The following observations were made:

At first week of age the average highest gain in weight in body of broilers was recorded in T_2 (128.48 g) followed by T_1 (120.55 g), T_3 (118.39) and T_0 (103.67 g).

At second weeks of age the average gain in weight in body of broilers was recorded in T_0 (280.83 g), followed by T_3 (266.28 g), T_2 (261.27 g) and T_1 (241.57 g).

At third weeks of age the average highest gain in body of broilers was recorded inT_2 (475.74 g), followed by T_3 (459.44 g), T_0 (400.74 g), and T_1 (393 g).

At fourth weeks of age the average highest gain in weight in body of broilers was recorded in T_1 (703.76 g) followed by T_3 (702.73 g), T_2 (657.24 g) and T_0 (623.6 g).

Irrespective of weeks, the mean average gain in weight per broiler at first, second, third and fourth weeks of age was 117.77, 262.48, 431.97 and 671.83 g, respectively.

Irrespective of treatments, mean average gain in weight per broiler in T_0, T_1, T_2 and T_3 was 352.21 g, 364.72 g, 380.43 g and 386.71 g respectively.

The differences in the average gain in body weight of broilers, both due to treatments and weeks were significant (Table 8). From the perusal of data on weekly average gain in weight per broilers after four weeks of age, contained in Table 7. It may be noted that mean gain in weight per broiler, irrespective of weeks, at first, second, third and fourth weeks of age 117.77, 262.48, 431.97 and 671.83 g respectively and when the treatment of weight gain was recorded the highest weight gain was observed T_3 (386.71 g), T_2 (380.43 g), T_1 (364.72 g) and T_0 (352.21 g) However, the differences in these values between the weekly treatments were found to be significant, which indicated there was a significant effect of treatments on gain in weight of broilers.

Table 7: Average weekly means gain in weight (g) per broiler in different treatments.

Treatments	W_1	W_2	W_3	W_4		Mean
T_0	103.67	280.83	400.74	623.6		352.21
T_1	120.55	241.57	393	703.76		364.72
T_2	128.48	261.27	474.73	657.24		380.43
T_3	118.39	266.28	459.44	702.73		386.71
Mean	117.77	262.48	431.97	671.83		

Table 8: ANOVA for data on weekly gain in weight of per broiler

ANOVA					
Source of Variation	**SS**	**df**	**MS**	**F**	**F tab**
Treatment	2912.921	3	970.9737	1.121953	3.862548
Weeks	680470.3	3	226823.4	262.0927	3.862548
Error	7788.888	9	865.432		
Total	691172.1	15			

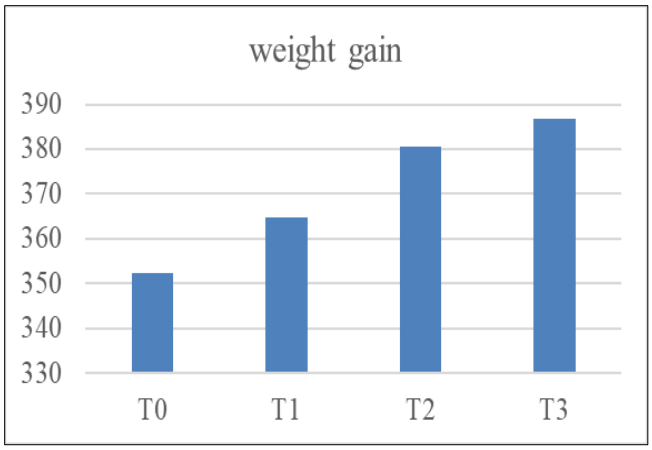

Fig 2: Average weight gain (g) of broilers

Conclusion

It was concluded that there was a significant "Effect of varying Neem and Tulsi supplementation on the body weight and Gain in weight of Broilers in a Deep Litter System" on body weight and gain in weight of broiler.

According to body weight and gain in weight, T_3 i.e., Neem (*Azadirachta indica*) and Tulsi (*Ocimum sanctum*) @ 5 gm per Kg Feed was observed as most effective treatments compared to rest of the treatments including control on body weight and gain weight of deep litter broiler reared under the experiment. All treatments were found better compared to control they helped to enhance the performance against the month of November. All treatment combinations of Neem and Tulsi powder supplementation in feed *viz*. T_1, T_2, T_3 were found significantly effective compared to control (T_0). The results indicated that use of Neem and Tulsi in broiler diets may be used to enhance the performance of broiler during month of November.

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