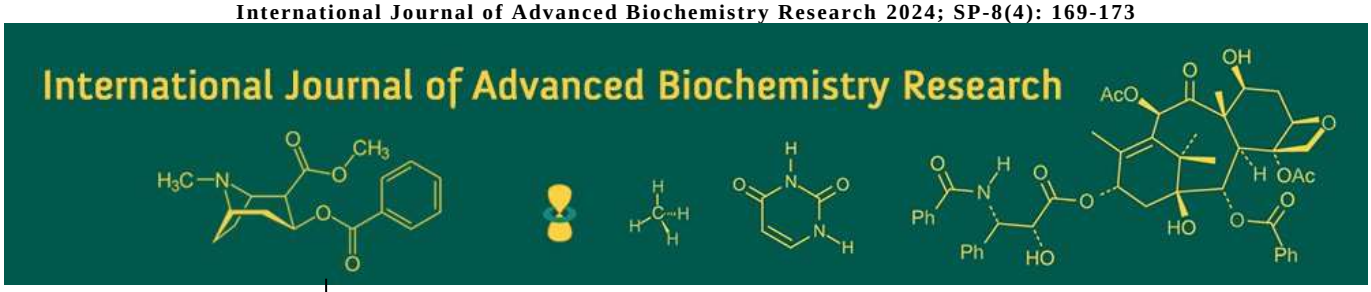

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Evaluation of Shatavari (*Asparagus racemosus*) root meal supplementation on growth performance and economics of broiler farming

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Abstract
In the commercial poultry industry, antibiotics are applied for various intents, including feed as growth promoters that elaborate antimicrobial resistance (AMR). We're facing challenge to disrate AMR without affecting the growth performance. The goal of the current study was to find out how Shatavari (*Asparagus racemosus*) root meal supplementation affects broiler chicken growth and haematological characteristics. At the Livestock Farm Complex, C.V.Sc. & A.H., Kumarganj, Ayodhya, U.P., the study was conducted for 42 days. One control group and three treatment groups, each with 50 chicks, were given the following treatments: TC (0% Shatavari root powder), T_1 (0.5% Shatavari root powder), T_2 (1% Shatavari root powder), and T_3 (1.5% Shatavari root powder). A completely randomized design (CRD) was used to divide each group into two replicates of 25 chicks each. At the conclusion of the trial, T_2 had the largest body weight (2547.76 g), followed by T_1, TC, and T_3. The TC group exhibited the highest overall feed intake (4339.64 g), followed by T_1, T_2, and T_3. T_2 and T_1 had the lowest FCR (1.58), which was followed by T_3 and TC. In comparison to the TC, the mean Hb concentration of the T_2, T_3, and T_1 groups of birds was considerably greater (p 0.05). Birds in the T_2 group had considerably greater PCV% than those in the TC, T_1, and T_3 groups. In comparison to the treatment groups, the TLC of TC was considerably (p 0.05) lower. For the groups TC, T_1, T_2, and T_3, the H:L ratios were determined to be 0.47, 0.49, 0.54, and 0.52, respectively. Therefore, it can be inferred that broiler chickens growth performance and haematological parameters are much higher when 1% Shatavari (*Asparagus racemosus*) root powder supplementation is added to their commercial diet.

Keywords: Shatavari root powder, supplementation, broiler birds, FCR, economics

Introduction
One of the key elements of a farmer's economy is poultry farming. In the shortest amount of time, it gives a huge number of rural populations new income and employment prospects. Due to the rising demand for poultry products, particularly in urban areas due to their high food value, poultry farming has gained major importance. Despite many obstacles, there has been a discernible rapid growth in development and production, largely due to local scientific approaches and improvements in chicken production equipment. Due to the promising productivity results from the upgraded broiler birds, broiler poultry has been used in India as a source of income for farmers who are struggling financially.

With an annual growth rate of 8%, the poultry business is one of Indian agriculture's fastest-growing segments. The number of chickens in the country has climbed by 16.81% since the most recent census, reaching 851.81 million. However, the population was 729.12 million at the previous census in 2019 (20th Livestock Census, 2019). Even though the Indian chicken sector saw amazing expansion, it has been plagued by a number of issues due to high ambient temperatures in the tropics and high humidity levels. Therefore, broiler poultry farming is encouraged in order to continue chicken output and improve the socioeconomic standing of Indian farmers.

Recently, efforts have been undertaken to use herbs with medicinal potential to prevent the negative effects of varying levels of stress and increase the production potential in broilers. Numerous herbal remedies, such as herbal growth promoters that improve the hepatic functions of birds, have been researched on various chicken species.

They improve feeding, aid in amino acid synthesis, and lessen the impact of aflatoxin. The promoter increases protein content while notably lowering blood cholesterol levels. By making feed more digestible, herbal feed additives are known to increase feed consumption (Kumar *et al*., 2006; Nagar *et al*., 2021) [16, 21]. The "Queen of herbs" is shatavari (*Asparagus racemosus*), a woody climber with finger-like, clumsy roots that can reach heights of 1 to 2 meters. Because the leaves are uniformly small and shaped like pine needles, the inflorescence contains tiny white flowers on short spikes. This plant is a member of the Liliaceae family, which is widespread in tropical areas at low altitudes in India, Asia, Australia, and Africa. Ayurvedic classics such the Charak Samhita, Susruta Samhita, and Astanga Samgraha all reference shatavari (Singh *et al*., 2009; Raghav and Kasera 2012) [27, 23]. Shatavari is employed in a variety of pharmaceutical formulations because it has nutritional, antistress, adaptogenic, immunomodulatory, galactogogue, anabolic, and performance-enhancing characteristics (Kamat *et al*., 2000; Chopra *et al*., 1956; Chopra *et al*., 1958; Mandal *et al*., 2000; Bopna and Saxena 2007; Bharati and Kumar 2019) [12, 4, 5, 18, 3, 2]. Shatavari contains Shatavarins 1 to 4, four steroid saponins, according to current chemical studies. The main glycoside of sarsasapogenin is shatavarin 1, which has three glucose and one rhamnose sugar moiety. Shatavari 4 comprises two glucose and one rhamnose and is structurally related to shatavarin 1. Shatavari may serve as a calming tonic, alternate demulcent and refrigerant overall. It enhances vigour and power while nourishing and rejuvenating the tissue. It has astringent, emollient, cooling, nervine, and bitter properties. It is utilized for general senility as well as blood illnesses and nervous system abnormalities. Given these nutritional advantages of the herb shatavari (*Asparagus racemosus*), research has been done to determine the impact of adding shatavari root powder to the diet of broiler chicks to support the growth of broilers (Sharma *et al*., 1986; Mane *et al*., 2012; Kumar *et al*., 2019; Nagar *et al*., 2020; Gaikwad *et al*., 2018) [26, 19, 17, 20, 7]. Recent research has also examined how Shatavari root meal affects broiler immunity, blood biochemical features, and carcass quality traits (Kant *et al*., 2014; Dahale *et al*., 2014; Ukey and Mangle 2010; Kant *et al*., 2016) [14, 6, 28, 13]. To evaluate the effectiveness of Shatavari root meal at different levels on the productive performance and economics of poultry farming, this study has been undertaken.

Materials and Methods

The goal of the current study was to find out how Shatavari root meal, a nutritional supplement, and affected broiler chicken production parameters like feed intake, body weight gain, feed conversion ratio, economics. The study was carried out at Livestock Farm Complex, College of Veterinary Science and Animal Husbandry, Kumarganj, Ayodhya, U. P. (224229), India. In the present study of 42 days of experimentation period was conducted on day old chicks. In a completely randomized experimental design, 200 straight-run commercial broiler chicks were divided into four groups: control (TC), three treatment groups (T_1, T_2 and T_3), each of which contained 50 chicks. T_1 contained 0.5% Shatavari root powder, T_2 contained 1% Shatavari root powder, and T_3 contained 1.5% Shatavari root powder. Both the starter and finisher rations were supplemented with Shatavari root powder at the dosage level chosen for the individual treatment groups.

Body weight and Body weight gain: With the help of a computerised weighing balance, the body weight of each individual chick was measured on day 0 and at weekly intervals up to 42 days of the experimentation period.

Feed intake and Feed conversion ratio: The average feed intake per bird was calculated by dividing the total feed intake by the number of births while accounting for mortality, if any, in the particular pain. Each replicate of the treatment group was given a fixed amount of feed on a daily basis. At the end of each week, feed consumption was calculated by subtracting the residual feed from the total feed offered during different days of the week. Every week, the feed conversion ratio was calculated.

Economics of broiler production

The economics of broiler production was calculated by considering inputs *viz*., cost of day old chicks, feeding cost and cost of Shatavari supplement. The prevailing market rates of feed and Shatavari supplement considered for this purpose. Birds consumed two types of feed *viz*. starter (1-21 days) and finisher (22-42 days). The cost of feed for the above two types of feed in different treatment groups as well as control group is different, since the level of inclusion of Shatavari is differed, assuming cost of sun dried Shatavari root is about Rs. 500/ kg., the basic cost of starter feed was Rs. 29.00/Kg and finisher was Rs. 27.50/Kg. The entire cost of the feed utilized for each bird for a period of up to six weeks was computed. The vaccine, medication, and other miscellaneous costs were estimated at Rs. 5.00 per bird. The price of day-old broiler chicks was Rs. 42 per chick, on top of the overall cost per bird. The returns of per birds was calculated by subtracting total input cost per bird from total output cost per bird in rupees.

Statistical Analysis. Data were statistically analyzed using the SPSS 20.0 programme. ANOVA was performed on the collected data, and Duncan's Multiple Range Test (DMRT) was used to compare means.

Results and Discussion

Body Weight Gain: In Table 1, the least expensive methods for increasing the body weight of broiler chickens fed various levels of Shatavari root meal are shown. In weeks 1 and 2, there was no discernible difference between the body weight gains of the various groups of broiler chicken. The T_2 group had the highest body weight at the end of the third week, which was significantly greater than the weights of the other three groups. However, there was no significant difference between T_1 and TC's body weight gain while significantly greater than T_3 group. At the end of the fourth week, the T_2 group had a significantly greater body weight gain (13741.63 g), followed by the T_1, TC, and T_3 groups (1252.45 g). The body weight gain of the T_2 and T_1 groups did not differ significantly at week 5, but both were higher than the TC and T_3 groups, which differed considerably from one another. At week 6, the T_2 group had considerably higher body weight gain (2547.76 g), while the T_3 group had the lowest (2273.97 g). At week 6, there was no discernible difference in body weight gain between the T_1, and TC groups.

The results are consistent with earlier findings by Dahale *et al*. (2014) [6]; Gaikwad *et al.* (2015) [9]; Mane *et al*. (2012) [19]; Gaikwad *et al.* (2014) [8]; Kumar *et al*. (2019); Gaikwad *et al*. (2018) [7] who found that adding shatavari root meal in broiler diet have Significantly (p<0.05) higher body wit gain in 0.5% and 1% *Asparagus racemosus* (shatavari) root powder supplemented group as compared to control in broilers

Table 1: Effect of Shatavari root meal supplementation on average weekly body weight (g) gain of boiler chickens.

Attributes	TC	T_1	T_2	T_3	SEM	P-value
1WK	185.30	185.67	186.35	186.06	1.815	0.9788
2WK	432.20	434.03	436.10	428.58	3.720	0.5329
3WK	815.97^{b}	817.51^{b}	831.45^{a}	777.78^{c}	2.137	0.5329
4WK	1,307.38^{c}	1,324.74^{b}	1,374.63^{a}	1,252.45^{d}	3.694	<.0001
5WK	1,858.37^{b}	1,888.76^{a}	1,896.20^{a}	1,727.10^{c}	6.599	<.0001
6WK	2,423.03^{b}	2,442.39^{b}	2,547.76^{a}	2,273.97^{c}	14.248	<.0001

Means with different small letters upper scripts between groups differ significantly (p<0.05).

Feed Intake: Table 2 shows the least necessary meal of feed consumed per bird on a weekly basis for grill chickens fed various levels of Shatavari root meal. The T_3 group had the highest feed intake during the first week, which was significantly (p<0.05) higher than that of the other three groups. The feed intake of the TC and T_1 groups, however, did not significantly differ from one another, but they were significantly lower than the T_2 group. The T_3 group had the highest feed intake during the second week, and this was considerably (p<0.05) higher than the feed intake of the other three groups. However, the feed intake of the T_1, and T_2 groups did not differ substantially from one another (p<0.05), but it was much higher than that of the TC group. At the third, fourth, and fifth weeks, the TC group had significantly (p<0.05) higher feed consumption than the T_1, T_2, and T_3 groups. At week 6th, the Tc group recorded the highest feed intake (1326.76 g) and the T_3 group the lowest (1222.08 g), both significantly (p<0.05). Additionally, there was a significant difference in feed intake (p<0.05) between the T_1 and T_2 groups at week 6th, yet the T_1 group had a much higher feed intake than the T_2 group.

The results are consistent with an earlier finding by Dahale *et al*. (2014) [6]; Kumar *et al*. (2019); Gaikwad *et al*. (2018) [7] that the broiler TC group consumed more feed on average than the 0.5% Shatavari supplemented group.

Table 2: Effect of Shatavari root meal supplementation on average weekly feed intake of boiler chickens.

Attributes	TC	T_1	T_2	T_3	SEM	P-value
1 wk	176.12ba	176.56ba	175.64b	177.64a	0.619919	0.1353
2nd wk	365.60c	375.20b	374.44b	387.16a	0.773929	<.0001
3rd wk	572.84a	564.76b	537.40c	533.88d	0.906127	<.0001
4th wk	831.32a	810.84b	781.56c	742.36d	0.532571	<.0001
5th wk	1,067.00a	1,038.32b	997.00c	947.32d	0.723671	<.0001
6th wk	1,326.76a	1,301.60b	1,258.04c	1,222.08d	0.726683	<.0001

Means with different small letters upper scripts between groups differ significantly (p<0.05).

Feed Conversion Ratio: The least require means of feed conversion ratio of broiler chicken feed different levels of Shatavari root meal are presented in Table 3. In the first week, there was no significant (p<0.05) difference between the feed conversion ratios of the several groups of broiler chicks. The T_2 and T_3 groups had the highest feed conversion ratio at the end of the second week, which was noticeably greater than the TC and T_1 group. T_2, however, and T_3 did not appreciably differ from one another. At the third week, TC and T_3 had a significantly (p<0.05) greater feed conversion ratio than T_1 and T_2, which was thereafter followed by them. The TC group had the highest feed conversion ration at week 4 compared to the other three groups. T_1 and T_3 did not significantly differ from one another, whereas T_2 group had much greater levels. By the fifth week, there was no significant (p<0.05) difference between the TC, T_2 and T_3 groups, but there were significantly (p<0.05) higher than T_1 group. T_1, T_3, and TC did not significantly differ from one another at week 6 but were significantly higher than the T_2 group.

The findings concur with earlier findings by Kant *et al.* (2015) [15]; Pandey *et al*. (2013) [22]. Rekhate *et al*. (2010) [25]; Kumar *et al*. (2019); Gaikwad *et al*. (2018) [7] reported that supplementing broiler chickens with Shatavari root powder at concentrations of 0.5%, 1%, and 1.5% improved feed conversion efficiency when compared to the control group.

Table 3: Effect of Shatavari root meal supplementation on average weekly feed conversion ratio of boiler chickens.

Attributes	TC	T_1	T_2	T_3	SEM	P- value
1WK	1.25	1.23	1.22	1.23	0.018	0.846
2WK	1.49^{b}	1.52^{b}	1.61^{a}	1.61^{a}	0.030	0.0069
3WK	1.50b^{a}	1.47^{b}	1.37^{c}	1.54^{a}	0.017	<.0001
4WK	1.70^{a}	1.60^{b}	1.44^{c}	1.57^{b}	0.013	<.0001
5WK	1.94^{a}	1.84^{b}	1.93^{a}	1.99^{a}	0.022	<.0001
6WK	2.40^{a}	2.35^{a}	1.96^{b}	2.32^{a}	0.066	<.0001

Means with different small letters upper scripts between groups differ significantly (p<0.05).

Economic viability of boiler chicken production

The data on economic analysis have been presented in Table The cost of chicks, cost of per kg feed, average feed consumption, average live weight, total cost of rearing birds and supplement expenditure on per bird were considered to determine the economics of broiler chickens production of supplementation of different level of Shatavari root meet. In the table 4. it distinctly show the cost of production per bird as 171.38, 171.62, 177.62 and 183.95 per TC, T_1, T_2 and T_3. The benefit cost ratio of different treatment per bird was

1.27, 1.28, 1.29, and 1.11 per Tc, T_1, T_2, T_3 treatment respectively. As the net earnings (Rs/ha) acquire in T_2 and T_1 were higher than the Tc and T_3 due to more body weight gain. The maximum benefit cost ratio acquire in T_2 (1% Shatavari) treatment followed by T_1 (0.5% Shatavari), Tc (0% Shatavari) and T_3 (1.5% Shatavari). The net earning per bird was signify and 46.68, 48.19, 51.67 and 20.70 for Tc, T_1, T_2 and T_3 groups respectively. The total net profit was higher in T_2 (1% Shatavari) groups. The net margin was reduced as increase in the above level of (1% Shatavari) root meal which was due to lower body weight gain and increase the cost of Shatavari supplement.

Table 4: Show the cost of production per bird as 171.38, 171.62, 177.62 and 183.95 per TC, T_1, T_2 and T_3

S.N.	Particulars		Treatments			
			Tc	T_1	T_2	T_3
Inputs (Rs)						
1.	Price of day old chick		42	42	42	42
2.	Total feed consumption/bird (kg)	Starter	1.137	1.115	1.087	1.098
		Finisher	3.325	3.150	3.036	2.911
3.	Total cost of feed (Rs.)	Starter	32.973	32.335	31.523	31.842
		Finisher	96.425	86.625	83.49	80.05
4.	Supplement feed cost @ 500/kg		0	10.66	20.61	30.06
5.	Total working cost (**1+3+4**)		171.389	171.62	177.623	183.95
Output (Rs)						
6.	Average body weight/bird (g)		2423.03	2442.39	2547.76	2273.97
7.	Market price (Rs/kg)		90	90	90	90
8.	Gross return (Rs/bird)		218.072	219.815	229.298	204.65
Income (Rs)						
9.	Net income (Rs/bird)		46.68	48.19	51.67	20.70
10.	Benefit:Cost ratio		1.27	1.28	1.29	1.11

Conclusions

Investigating the effect of *Shatavari* (*Asparagus racemosus*) root powder supplementation on broiler chickens performance it may be concluded that inclusion of 1% Shatavari (*Asparagus racemosus*) root powder supplementation on commercial diet is significantly higher for growth performance and haematological parameters of broiler chickens.

Future Scope

Shatavari root meal has multidimensional uses and it is used in poultry and livestock since long back. Shatavari root meal may also be used for increase production of milk yield in livestock animal. The literature cited by various scientists as well as recent experiments, the following studies can be done as future scope of research. Similar study can be conducted in commercial layer production. A detail study may be conducted by using Shatavari powder in commercial broiler chicken. Various studies of use of Shatavari root meal in dairy cattle, sheep and goat may be performed.

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Conflict of Interest: None.

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