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Effect of Dietary Supplementation of Turmeric Powder (*Curcuma longa*) and Vitamin C on Carcass Characteristic and Economics of Pratapdhan Chicken

Manoj Jat[1*], Manoj Kumar[1], Keshram Meena[1], Sunita Kumari Gurjar[1], Lokesh Gupta[2] and J.L. Choudhary[3]
[1]Ph.D. Scholar, Department of Animal Production, RCA, MPUAT, Udaipur (Rajasthan), India.
[2]Professor, Department of Animal Production, RCA, MPUAT, Udaipur (Rajasthan), India.
[3]ICAR- Emeritus Professor, Department of Animal Production, RCA, MPUAT, Udaipur (Rajasthan), India.

(Corresponding author: Manoj Jat)*
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ABSTRACT: The study was conducted to investigate the effect of dietary supplementation of turmeric powder and vitamin C on carcass characteristic of pratapdhan chicken. A total 160 numbers of day-old commercial Pratapdhan chicks with uniform of body weight were divided into 4 treatment groups with 4 replications, each consisting of 10 chicks following a completely randomized design. They will be reared under cage system of housing for six weeks with identical standard management practices. The birds were subjected to four dietary treatment containing basal ration as T_1: (Basal diet) control, T_2: Basal diet supplemented with 0.5% turmeric powder, T_3: Basal diet supplemented with 300mg kg^{-1} vitamin C and T_4: Basal diet supplemented with turmeric powder + 300 mg kg^{-1} vitamin C. At end of the experiment, 4 birds from each treatment groups randomly selected were slaughtered to obtain carcass characteristic data. Result showed that a live weight, dressed weight, eviscerated weight and giblet weight significantly highest in group of birds fed diets containing T_4 group as compared to rest of the treatment groups but non-significant effect was found in dressing weight, eviscerated weight and giblet weight percentage among different treatment groups. B:C ratio was significantly higher in T_4 group. The results of present investigation revealed that inclusion of T_4 had positive effect on economic performance of Pratapdhan chicks.

Keywords: Chicks, Turmeric powder, Vitamin C and carcass yields.

INTRODUCTION

Today in India, the poultry industry is among the fastest-growing sectors in agriculture. Raising birds such as chickens, ducks, turkeys, and geese for meat or egg production is one type of animal husbandry. Poultry meat consumption is increasing as consumers are attracted not only by lower prices but also by the consistency and adaptability of the product, as well as higher protein and fat content. urgently, with the rapid increase in population and consequent ever-increasing need for food, especially protein, meeting the nutritional needs of the human population is of the greatest importance in human society (Lishianawati and Yusiati 2021). In re-cent years, poultry meat as a source of animal protein has become increasingly important in human nutrition as it is becoming more competitive day by day in relation to other consumed meats and their products.

According to the 20th Livestock Census (BAHS, 2019), the total poultry population in the country reached 851.81 million, reflecting a 16.8% increase compared to the previous census. The backyard poultry population stood at 317.07 million, marking a significant rise of 45.8%. Meanwhile, the commercial poultry population was recorded at 534.74 million, showing a more modest increase of 4.5% over the previous census.

India is the 2nd largest producer of eggs in the world in 2023-24, the country produced about 142.77 billion eggs. On average, each person in India had access to around 103 eggs in a year. Egg production 3.17 % increase compared to the previous year. India also ranks 5th in the world for meat production. Meat output 10.25 million tonnes in 2023-24, 4.95 % increase compared to the previous year according to the DAHD Annual Report 2024.

India's poultry processing landscape comprises numerous small-scale facilities nationwide that produce processed chicken. In addition to these, there are five modern integrated poultry processing plants that produce dressed chicken, chicken cut parts, and other chicken products. According to the OECD and FAO Agricultural Outlook 2030, poultry meat is projected to

account for 41% of all meat-based protein consumption globally by 2030, reflecting a 2% increase compared to the baseline period.

Turmeric (*Curcuma longa*), known for its antimicrobial, anti-inflammatory, and immune-boosting properties, has emerged as a promising substitute. Studies have demonstrated that turmeric supplementation can improve growth performance, enhance gut health, and reduce disease incidence in poultry. which is involved in many medicines and anti-liver diseases and anorexia (Toghyani *et al.,* 2011), is a perennial herbal plant of the ginger family, Zingiberaceae, and its active ingredients are tetrahydrocurcumin, curcumin, dimethoxycurcumin and Bisde methoxy cocurcumin (diferuloylmethane) It's the natural yellow dye in the roots of turmeric. It is characterized by its high content of pharmacologically active compounds that stimulate appetite and food intake (Nouzarian *et al*., 2011); turmeric powder added to the diet has the best effects on productivity and immune response. Hleap-Zapata *et al.* (2020) showed that the active ingredient of turmeric as a feed supplement was curcumin and its various derivatives such as demethoxycurcumin, bisdemethoxycurcumin and tetrahydrocurcuminoid. Herbal supplements can improve growth performance, carcass characteristics and immune status in broiler chickens (Demirhan, 2020). The use of turmeric in the diet increases the activity of antioxidant enzymes such as superoxide dismutase, catalase and glutathione peroxide in the liver and reduces the amount of lipid peroxidation by removal of free radicals (Isroli *et al.*, 2017). The results of the experiment showed that different levels of turmeric had a significant effect on performance, carcass characteristics (Moniei *et al.,* 2024).

The role of vitamin C as an immune modulator has been well recognized. When the immune system is under stress, the body requires significantly higher amounts of vitamin C. Therefore, supplementing feed with appropriate levels of vitamin C can help enhance immunity in birds. Under stressful conditions, chickens may struggle to produce sufficient amounts of vitamin C, and in such cases, adding ascorbic acid to their diet may be beneficial. Given the importance of vitamin C in broiler production (Brake, 1987). As for vitamin C, it is one of the most important vitamins that must be added to the food of the living organism (human and animal) as a result of the role it plays in increasing the productive efficiency and the vital activities carried out by the organism (Tollba *et al.,* 2007). And the deficiency of one of these vitamins from the food leads to diseases and symptoms of nutritional deficiency (Weber, 2009; Zhang *et al.,* 2012). Indicated that vitamin C is one of the most powerful antioxidants, as well as the positive effects of this vitamin on the productive performance of broilers (Taha, 2008).

MATERIALS AND METHODS

Experimental Site: The proposed work was carried out at Poultry Farm, Department of Animal Production, Rajasthan College of Agriculture, MPUAT, Udaipur, located in sub-humid southern plains region at latitude 24.57 North and longitude of 73.70 East with height from the mean sea level 598 meters. The mean maximum and minimum temperature of the last decade were 38.3 and 11.6ºC, while the average annual rainfall was 646.7 mm.

Experimental birds: For the present study, a total 160 day-old, apparently healthy Pratapdhan chicks were procured from the hatchery unit of Poultry Farm, Department of Animal Production, Rajasthan College of Agriculture, MPUAT. All the chicks were weighed individually and randomly divided in to 4 treatments groups consisting of 40 chicks in each treatment group in 4 replicates of 10 birds each.

Experimental details

1.	Birds	:	Pratapdhan chicken
2.	Period	:	6 weeks (October, 2023 to November, 2023)
3.	Total treatments	:	four
4.	Replications	:	four
5.	No. of birds / treatment	:	40
6.	No. of birds / Replications	:	10
7.	Total number of birds	:	one hundred sixty
8.	Experimental design	:	CRD
9.	Housing	:	Cage system
9.	Location	:	Department of Animal Production, Rajasthan College of Agriculture, Udaipur (Raj.)

Experimental diet: feed were procured from Department of Animal Production, Rajasthan College of Agriculture Udaipur. This ensured consistent quality without compromising the health of the birds. The Pratapdhan chickens were provided with a chick ration from day one until the conclusion of the experimental period. This ration was formulated using maize, soybean meal (soya-doc), and dicalcium phosphate. All experimental birds were fed isonitrogenous and isocaloric diets containing 22% crude protein (CP) and 2900 Kcal metabolizable energy (ME).

Table 1: clearly diffracts the characteristics of experimental feed in various treatments groups.

Treatment	Treatment Groups
T_1	Basal diet (Control)
T_2	Basal diet with 0.5% turmeric powder
T_3	Basal diet with 300mg kg^{-1} vitamin C
T_4	Basal diet with T_2+ T_3

Feeding, watering and health management: All experimental birds were raised in well-ventilated sheds with Cage system and maintained under uniform management conditions. Clean, fresh water was readily available at designated access points. Throughout the experimental period, the birds were provided with ad libitum access to both feed and water. To reduce stress and supply immediate energy, glucose water was offered to the chicks upon arrival. Each chick was

individually assisted by dipping its beak into the solution to ensure intake. A fixed amount of feed was provided each morning and evening. All birds in each experimental group were weighed weekly in the morning, prior to feeding and watering. Vaccination and other routine biosecurity and poultry management practices were meticulously implemented.

Composition of ration. Ingredient and nutrient composition of chick ration in different treatments are presented in Table 2, respectively.

Table 2: Ingredient and nutrient composition of chick ration.

Ingredient Composition				
Feed Ingredients	**Treatments**			
	T1	**T2**	**T3**	**T4**
Maize (kg)	60	60	60	60
Soya–doc (kg)	38	37.5	37.7	37.2
Turmeric powder (kg)	0	0.5	0	0.5
Vitamin C (kg)	0	0	0.3	0.3
Dicalcium phosphate (kg)	2	2	2	2
Total	100	100	100	100
Nutrient Composition				
Dry Matter (%)	89.68	89.12	89.95	90.12
Crude Protein (%)	22.5	22.28	22.37	22.14
Crude Fibre (%)	3.83	3.80	3.82	3.78
Ether Extract (%)	3.09	3.08	3.09	3.09
Total Ash (%)	3.71	3.68	3.69	3.65
Nitrogen Free Extract (%)	66.87	67.16	67.03	67.34
Metabolizable Energy (Kcal/kg)	2930	2918	2923	2910

Evaluation of carcass traits: At the end of the experiment To analyses the effect of turmeric powder and vitamin C supplementation on carcass traits of Pratapdhan chicken viz. live weight, dressed weight, eviscerated weight, giblet weight, dressed weight percentage, eviscerated weight percentage, giblet weight percentage, 4 birds from each treatment groups were randomly selected, starved for 12-14 hours and slaughtered at the end of the experiment. Selected birds had the live weight similar to the mean live weight of population concerned.

Live weight (g). Live weight of individual Pratapdhan chicken was recorded before slaughtering. It was measured with the help of electronic weight balance.

Dressed weight (g). Slaughtering was done by the jugular vein. The five minutes bleeding time was allowed for each bird. After keeping the birds in hot water (60ºC) for one minute (Sahoo and Panda 1983) scalding was done manually, the head was removed at attanto-occipital joint, shank were cut at the hock joints and dressed weight was recorded.

$$\text{Dressed weight} = \frac{\text{Live weight} - \text{weight of blood, feathers, shank and head}}{\text{Live weight}} \times 100$$

Eviscerated weight (g). The birds were eviscerated by giving a median cut in the abdomen. Giblet (heart, liver and gizzard) were cleaned and retained along with carcass to record eviscerated weight and expressed as percentage of pre slaughter weight.

$$\text{Eviscerated weight} = \frac{\text{Dressed weight} - \text{weight of viscera except giblet}}{\text{Live weight}} \times 100$$

Giblet weight (g). For the giblet weight, combined weight of heart, liver and gizzard was measured by electronic weight balance and expressed as percentage of pre slaughter live weight.

$$\text{Weight of giblet (g)} = \frac{\text{Weight of giblet (g)}}{\text{Pre-slaughter live weight (g)}} \times 100$$

Effect on economics of production. The cost of production at six weeks of age was calculated taking into consideration the Sum of variable costs, including feed expenses with supplements and other cost. The gross return was calculated by multiplying overall body weight gain with the prevailing sale price of birds. The net return was calculated by subtracting total cost from the gross return. The B: C ratio was then computed using the following formula.

$$\text{B : C ratio} = \frac{\text{Total return}}{\text{Total cost}}$$

Ethical Consideration: Animals were sacrificed using humane methods in accordance with the guidelines outlined in the 'Statement of Human and Animal Rights,' including provisions for informed consent and ethical approval.

Statistical Analysis: To draw reliable conclusions and assess the effects of different treatments, the experimental data were statistically analyzed. Following the methodology outlined by Snedecor and Cochran, the data were examined using Microsoft Excel's One-way Analysis of Variance (ANOVA) within a Completely Randomized Design. All statistical analyses were performed using Microsoft Excel, with a significance level set at 5%.

RESULTS AND DISCUSSION

Carcass Traits: The data pertaining to carcass parameters of Pratapdhan chicks estimated at the end of experiment in different treatment groups are tabulated in Table 3. The data revealed that live weight, dressing weight, eviscerated weight, and giblet weight differed significantly among different treatment groups, while the per cent dressing weight, eviscerated weight, and giblet weight did not differ significantly among different treatment groups.

The live weight of Pratapdhan chicks was 325.87±1.67, 438.64±1.19, 356.93±0.82 and 444.26±1.68 g in T1,

T2, T3 and T4, respectively. Significantly highest live weight was observed in T4 (444.26±1.68 g) and T2 (438.64±1.19 g), followed by T3 (356.93±0.82 g) and significantly lowest live weight was observed in T1 (356.93±0.82 g). The mean dressed weight ranged from 258.74±1.37 to 358.45±2.34 g among different treatment groups. The dressed weight was significantly highest in T4 (358.45±2.34 g) followed by T2 (349.47±1.71 g), T3 (288.14±1.56 g) and significantly lowest dressed weight was observed in T1 (258.74±1.37 g). The eviscerated weight of Pratapdhan chicks was 194.12±0.97, 259.42±2.12, 214.12±1.44 and 264.76±2.23 g in T1, T2, T3 and T4, respectively. Significantly highest eviscerated weight was observed in T4 (264.76±2.23 g) and T2 (259.42±2.12 g), followed by T3 (214.12±1.44 g) and significantly lowest in T1 (194.12±0.97 g). The difference between T2 and T4 were found statistically non-significant. The mean giblet weight (g) ranged from 20.58±0.19 to 28.75±1.11 g among different treatment groups. The giblet weight (g) was significantly highest in T4 (28.75±1.11) followed by T2 (27.83±0.70 g), T3 (22.92±0.39 g) and significantly lowest giblet weight (g) was observed in T1 (20.58±0.19 g). The difference between T2 and T4 were found statistically non-significant.

The dressing per cent was 79.40±0.17, 79.67±0.49, 80.73±0.34 and 80.69±0.39 per cent in T1, T2, T3 and T4, respectively. The differences among different treatments were found statistically non-significant. The eviscerated weight (per cent) was 59.58±0.43, 59.14±0.49, 59.99±0.52 and 59.60±0.45 in T1, T2, T3 and T4, respectively. The differences among different treatments were found statistically non-significant. The giblet weight per cent was 6.32±0.07, 6.35±0.16, 6.42±0.10 and 6.47±0.23 per cent in T1, T2, T3 and T4, respectively. The differences among different treatments were found statistically non-significant.

The results obtained in this study were in line with the findings of the results of the experiment showed that different levels (250, 500, 750 and 1000 mg/kg diet) and a control treatment (without turmeric) of turmeric had a significant effect on performance, carcass characteristics, Raskar *et al.* (2019) whose results indicated that addition of turmeric powder caused significant increase in carcass weight and dressing percentage among different treatment 0, 0.5, 1, 2 and 3% turmeric in diets in chickens. Durrani *et al.* (2006) reported that supplementing TP at a rate of 0.5% significantly improved the dressing percentage. However, it had no significant effect on the weights of the liver, heart, or gizzard. These findings are consistent with those According to Al-Jaleel (2012), supplementation with turmeric powder at levels of 0.25%, 0.5%, 1.0%, and 1.5% had a positive effect on dressing percentage, while having no significant impact on gizzard and heart weights. Nouzarian *et al.* (2011) found that a significant decrease in abdominal fat pad and liver relative weight in chickens fed with the supplemented diets in order of control, 3.3, 6.6 and 10 g kg^{-1} with turmeric powder in broiler chickens. Kichu *et al.* (2023) revealed that on supplementation with turmeric powder the carcass weight was unaffected, but it showed a significant effect on dressing percentage and organ weights among treatments fed in the order of 0, 0.4, 0.6 and 0.8g kg^{-1} of feed in broiler chicken.

Table 3: Effect of turmeric powder and vitamin C supplementation on carcass traits of Pratapdhan chicken.

Parameter	Treatments groups					
	T1	T2	T3	T4	SEm±	CD
Live weight (g)	325.87±1.67^{d}	438.64±1.19^{b}	356.93±0.82^{c}	444.26±1.68^{a}	1.39	4.29
Dressing weight (g)	258.74±1.37^{d}	349.47±1.71^{b}	288.14±1.56^{c}	358.45±2.34^{a}	1.78	5.51
Eviscerated weight (g)	194.12±0.97^{c}	259.42±2.12^{a}	214.12±1.44^{b}	264.76±2.23^{a}	1.76	5.45
Giblet weight (g)	20.58±0.19^{c}	27.83±0.70^{a}	22.92±0.39^{b}	28.75±1.11^{a}	0.69	2.14
Dressing weight (%)	79.40±0.17	79.67±0.49	80.73±0.34	80.69±0.39	0.37	NS
Eviscerated weight (%)	59.58±0.43	59.14±0.49	59.99±0.52	59.60±0.45	0.48	NS
Giblet weight (%)	6.32±0.07	6.35±0.16	6.42±0.10	6.47±0.23	0.15	NS

Means with the same superscript in a particular row do not differ significantly (P<0.05) from each other

Singh *et al.* (2018) found that the dietary treatments did not affect sensory characteristics of carcass among treatments fed with 1.0 or 1.5% turmeric powder. Attia *et al.* (2017) reported no effect on relative weight of liver, pancreas and intestine of broiler chicken. Urusan and Bolukbasi (2017) observed that there is no significant difference in carcass yield and organs weight among the treatments with 0, 2, 4, 6, 8, 10 g kg^{-1} turmeric powder, Mondal *et al.* (2015) observed that there is significant decrease in abdominal fat pad and increase (P<0.05) in dressing yield but no difference was reported that weight of heart, liver and gizzard in chickens fed turmeric supplemented diets. Toghyani *et al.* (2011) showed that carcass characteristics were not significantly influenced by the dietary treatments at 42 day in broiler chicks. The carcass characteristics, including prime cuts and giblet weight, were not significantly affected (P>0.05) by vitamin C supplementation. Comparable findings have also been reported by other researchers Niu *et al.* (2009); Dalia *et al*. (2018).

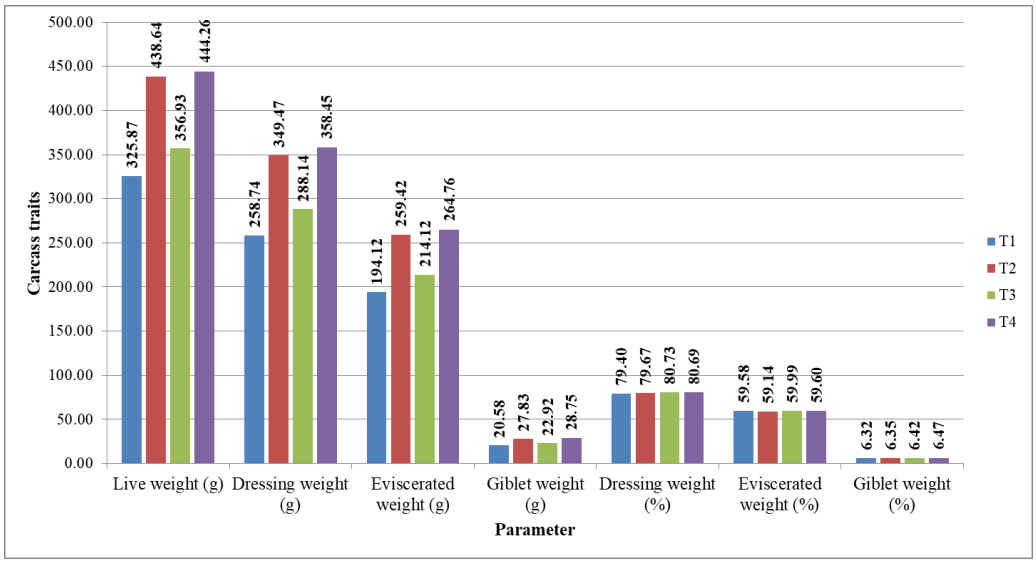

Fig. 1. Effect of turmeric powder and vitamin C supplementation on carcass traits of Pratapdhan chicken.

Cost benefit analysis: The total feed intake was 845.43±10.96, 974.93±16, 889.15±7.58 and 972.50±3.89a kg in T_1, T_2, T_3 and T_4 groups, respectively. The total feed costs were Rs. 24.60±0.32, Rs. 29.34±0.51, Rs. 27.37±0.23 and Rs. 30.51±0.123, respectively in T_1, T_2, T_3 and T_4 groups. The perusal of data revealed that the feed cost was significantly highest in T_4 followed by T_2, T_3 and significantly lowest in T_1.The total cost including cost of day-old Pratapdhan chicks, feed and miscellaneous cost were found to be Rs. 61.60±0.32, Rs. 66.34±0.51, Rs. 64.37±0.23 and Rs 67.51±0.12 in T_1, T2, T_3 and T_4 groups, respectively. The total cost was significantly highest in T_4 followed by T_2, T_3 and T_1.The mean body weight at 6th weeks of age was 318.69±1.95, 437.30±1.43, 355.66±4.03 and 443.92±2.84 g per chicks in T_4, T_2, T_3 and T_1 groups, respectively.

The gross returns (Rs/bird) were 63.73±0.39, 87.45±0.28, 71.13±0.80 and 88.78±0.56 in T_1, T_2, T_3 and T_4 groups, respectively. The perusal of data revealed that the gross returns was significantly highest in T_4 followed by T_2, T_3 and significantly lowest in T_1. The net return (Rs/bird) was 2.13±0.30, 21.11± 0.79, 6.76±0.99 and 21.26±0.61 in T_1, T_2, T_3 and T_4 groups, respectively. The perusal of data revealed that the net returns were significantly highest in T_4 as compared to rest of the treatment groups. The difference in net return between T_2 and T_4 was found statistically non-significant. The benefit cost ratio was also calculated and the values were 1.03±0.01, 1.31±0.01, 1.10±0.01 and 1.31±0.1. Data revealed that the benefit cost ratio was significantly highest in T_4 as compared to rest of the treatment groups. However, the difference in benefit cost ratio among T_2 and T_4 was found to be non-significant.

The data in Table 4 indicate that the broilers were sold based on live weight in the respective group. It was observed that all groups generated a profit. B:C ratio was significantly higher in (T_4) 0.5% turmeric powder + 300 mg kg^{-1} vitamin C and T_2 basal diet supplemented with 0.5% turmeric powder group. The results of present investigation revealed that inclusion of (T_4) 0.5% turmeric powder + 300 mg kg^{-1} vitamin C T_2 basal diet supplemented with 0.5% turmeric powder had positive effect on economic performance of Pratapdhan chicks. Swain *et al.* (2012) observed that the higher net profit from the combination of turmeric powder at 0.5% level was in contract with the higher net profit and benefit cost ratio in broilers fed a 1.0 g/kg diet containing probiotics and yeast vanaraja chickens. Kefali *et al.* (2007) who reported that probiotic supplementation did not generate any additional revenue under the market conditions. Therefore, it is conduced that turmeric powder at 0.5% and feed for additive are better for maximizing profitability in broilers.

Table 4 : Effect of turmeric powder and vitamin C supplementation on economics of Pratapdhan chicken.

Parameter	Treatments groups					
	T1	T2	T3	T4	SEm±	CD
Feed intake (kg/birds)	845.43±10.96^{c}	974.93±16.95^{a}	889.15±7.58^{b}	972.50±3.89^{a}	10.96	33.77
Feed cost (Rs/birds)	24.60±0.32^{d}	29.34±0.51^{b}	27.37±0.23^{c}	30.51±0.12^{a}	0.32	1.02
Total cost (Rs/birds)	61.60±0.32^{d}	66.34±0.51^{b}	64.37±0.23^{c}	67.51±0.12^{a}	0.32	1.02
Overall weight (g)	318.69±1.95^{c}	437.30±1.43^{a}	355.66±4.03^{b}	443.92±2.84^{a}	2.75	8.47
Gross return (Rs/birds)	63.73±0.39^{c}	87.45±0.28^{a}	71.13±0.80^{b}	88.78±0.56^{a}	0.54	1.71
Net return (Rs/birds)	2.13±0.30^{c}	21.11± 0.79^{a}	6.76±0.99^{b}	21.26±0.61a	0.72	2.24
B:C ratio	1.03±0.01^{c}	1.31±0.01^{a}	1.10±0.01^{b}	1.31±0.1^{a}	0.01	0.03

Means with the same superscript in a particular row do not differ significantly (P<0.05) from each other

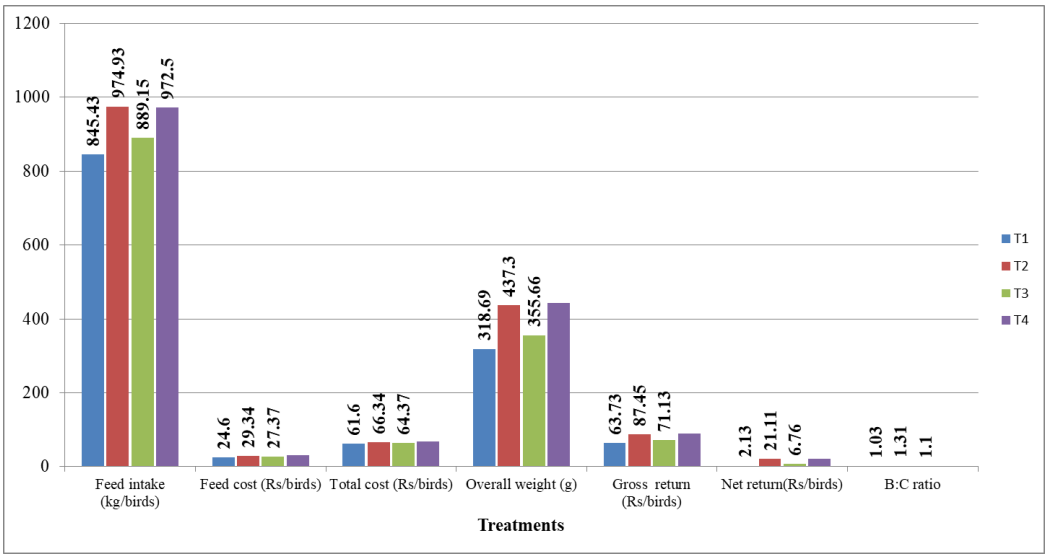

Fig. 2. Effect of turmeric powder and vitamin C supplementation on economics of Pratapdhan chicken.

CONCLUSIONS

The supplementation of turmeric powder and vitamin C was found to be beneficial in Pratapdhan chicken rearing for its encouraging results the carcass traits like live weight, dressed weight, eviscerated weight and giblet weight Significantly higher fed with 0.5% turmeric powder and 0.5% turmeric powder+300 mg kg^{-1} vitamin C but Non-significant effect was found for dressed weight, eviscerated weight and giblet weight percentage in Pratapdhan chicken among different treatment groups. The supplementation of turmeric powder and vitamin C was found to be beneficial in Pratapdhan chicken rearing for its encouraging results in relation the overall performance and economics benefits.

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