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VD Borkar

Ph.D Scholar, Department of AHDS, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India

ST Pachpute

Professor, AHDS Section, RSCM College of Agriculture, Kolhapur, Maharashtra, India

DK Kamble

Professor, Department of AHDS, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India

DK Deokar

Associate Professor, Department of AHDS, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India

SB Adangle

Asst. Professor, Department of AHDS, COA Karad, MPKV, Rahuri (MH), India

AT Lokhande

Assistant Professor, Department of AHDS, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India

Corresponding Author:

VD Borkar

Ph.D Scholar, Department of AHDS, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India

Effect of dietary supplementation of azolla powder on carcass, blood serum and proximate properties of breast and thigh muscles of Japanese quail

VD Borkar, ST Pachpute, DK Kamble, DK Deokar, SB Adangle and AT Lokhande

Abstract

The present experiment was conducted at the Poultry Unit, Veterinary Polyclinic and A.I. Center, Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri Dist. Ahmednagar, Maharashtra, India. The feeding trial of six weeks for growth performance was conducted which were subjected to four treatments and designated as treatment T₀, T₁, T₂ and T₃, respectively. Total 160 day-old chicks were selected for the experiment. The chicks fed with basal diet in control group (T₀), while chicks in treatment T₁, T₂ and T₃ were fed basal diet with Azolla meal powder @ 2.5, 5.0 and 7.5 percent each, respectively. All the birds were given isocaloric and isonitrogenous diets through the experimental period. The significant results observed in carcass parameters such as dressing percentage, breast percentage, thigh percentage and giblet percentage was significantly higher in treatment feeding with 7.5 percent level of Azolla meal. The serum cholesterol levels decrease as the level of azolla meal increased in the ration of Japanese quail. The inclusion of azolla in the diet had non-significant effect on moisture, protein, fat and ash content in the breast and thigh tissues.

Keywords: Japanese quail, azolla, carcass parameters, proximate analysis

Introduction

In the broiler industry, operations tend to be large-scale and exhibit a trend towards integration and contract farming. As a result, many small and marginal farmers have been compelled to exit farming and seek alternative livelihoods. Quail farming emerges as a viable alternative with significant potential, and its acceptance is gaining momentum. The quail, known as "bater" in Hindi, is a small bird belonging to the Pheasant family. The Japanese quail, also referred to as Coturnix quail (*Coturnix japonica*), is a species of old world quail native to East Asia. Quails were initially domesticated in Japan in 1595 and later introduced to America, Europe, and the Middle East during the period of 1930-1950. In India, quails were first introduced in 1974 from California. In India, two species of quails are found: the Black-breasted quail (*Coturnix coromandelica*) found in the jungle, and the brown-colored Japanese quail (*Coturnix coturnix sp. japonica*). The Japanese quail is bred for its eggs and meat, and it is utilized for commercial quail production.

One of the primary challenges facing the poultry industry is the high cost and limited availability of feed ingredients. As a result, feed costs often constitute more than 70 percent of the total production cost. While cereal grains are essential for poultry feed, global grain production is showing a downward trend. Additionally, utilizing animal protein resources in poultry diets is financially burdensome. In response to this situation, significant efforts are being made to identify new feed resources aimed at enhancing the efficiency and affordability of poultry production. In poultry feed, plant-based proteins are typically more economically feasible compared to animal-based proteins. However, limited research has been conducted in our country on the utilization of unconventional feed ingredients in poultry diets. Green plants have long been acknowledged as the most cost-effective and abundant potential source of proteins due to their capacity to synthesize amino acids from a wide array of readily available primary materials (Fasuyi and Aletor, 2005) [4].

Methodology

Experimental chicks

Total 160 day-old Japanese quail chicks were procured from winsome hatchery private limited, pune were used in the present experiment. All the chicks were individually weighed and randomly divided into four groups of 40 chicks each having almost similar average body weight. Each group of 40 chicks will further subdivided into four replicates having 10 chicks each in a completely randomized design (CRD).

Treatment details

The various feed ingredients used for formulating different experimental ration were purchased from the market in one lot before starting the experiment. The chicks were fed experimental diets with different levels of Azolla meal during the experimental period of five weeks of age. Four dietary groups designated at T₀, T₁, T₂ and T₃ were formulated by incorporating 0, 2.5, 5 and 7.5 percent level of dried Azolla.

Collection of blood sample

The blood samples were collected from four birds from wing vein in sterilized disposable syringes (sterilized needles). For estimation of biochemical parameters the blood samples were transferred to non-heparinized tubes for serum separation.

Separation of serum

For serum separation, the blood was collected by using a disposable syringe and allowed to stand at room temperature in slanting position for clotting for three to four hours. After clotting of blood, plunger was removed from the syringe and serum was collected in a sterile tube. The serum was stored at -20 °C with date and sample number for further analysis.

Carcass traits

Carcass traits were evaluated after slaughtering, dressing and evisceration of birds. Four birds from each treatment were used for carcass traits evaluation. Live weight was recorded prior to slaughter of birds. The birds were slaughtered by standard protocol and allowed to bleed for 180 seconds, in bleeding cones. The birds were then processed by removing the skin, head, shank, feet and preen glands were eviscerated by cutting around vent and removing the viscera. The giblets consisting of heart (without pericardium), liver (without gall bladder) and gizzard were cut open and rinsed of its contents. All of the above components and eviscerated carcass were weighed individually.

Statistical analysis

The treatment wise data obtain and data were analyzed by using Complete Randomized Design (CRD) and significance was considered at ($p < 0.05$) as per Panse and Sukhatme (1985)^[7].

Results and Discussion

Carcass traits

The carcass traits were analyzed, tabulated and presented in Table 1. The mean of live body weight at sixth week of age in groups T₀, T₁, T₂ and T₃ were 202.27, 208.36, 218.90 and 221.55 g respectively with an overall mean of 212.77 g. The statistical analysis of data on mean live body weight at sixth week of age showed the significantly ($p \leq 0.05$) different between the groups were T₃ and T₂ at par to each other as well as T₁ and T₀ at par to each other found during the slaughtering of birds. The average hot carcass weight after

slaughtering was recorded 151.25, 156.73, 165.90 and 168.54 g in treatment T₀, T₁, T₂ and T₃ respectively with an overall average mean 160.56 g. The statistically hot carcass weight resulted significant ($p \leq 0.05$) results and data showed numerically trend of higher carcass weight in 7.5 percent azolla incorporated group followed by 5.0, 2.5 and control treated group.

The average dressing percentage among the different treatment groups was recorded as 74.77, 75.22, 75.78 and 76.08 percent for treatment T₀, T₁, T₂ and T₃ respectively with an overall mean 75.46 percent. The difference among all the treatment groups were found to be significant ($p \leq 0.05$). Numerically higher dressing percentage was recorded in treatment T₃ followed by T₂, T₁ and T₀ it showed the positive and beneficial effects of dried Azolla meal feeding on dressing percentage. The percent breast recorded for the dietary groups T₀, T₁, T₂ and T₃ were 17.15, 17.23, 17.67 and 17.95 percent respectively with an overall mean of 17.50 percent with significantly ($p \leq 0.05$) higher value in diet containing 7.5 percent Azolla than control group. Giblet is a culinary term for the edible offal of a bird, typically including the heart, gizzard and liver. The giblet percent recorded for the dietary groups T₀, T₁, T₂ and T₃ were 4.09, 4.23, 4.46 and 4.81 percent respectively with an overall mean of 4.40 percent. The data showing statistically significant ($p \leq 0.05$) difference in dietary groups indicating higher percentage in diet containing 7.5 percent Azolla followed by 5.00 percent, 2.5 percent and lower in control group.

The drumstick percentage statistically revealed the non-significant ($p \leq 0.05$) difference among the treatments. The dietary groups T₀, T₁, T₂ and T₃ recorded 11.82, 11.77, 11.83 and 11.70 percent mean values of drumstick respectively with an overall mean of 11.78 percent. The thigh percent was comparable among the different dietary groups T₀, T₁, T₂ and T₃ and the mean values were 18.16, 18.19, 18.71 and 18.88 percent respectively with an overall mean of 18.48 percent. The statistically trend showed significant higher thigh percentage found in T₃ followed by T₂ and T₁ as well as T₀ groups at par to each other.

The similar results revealed by varadharajan *et al.* (2019)^[11], Borkar *et al.* (2021)^[12] reported that there was a significant difference ($p < 0.01$) in the weights of organs viz., heart, gizzard and giblets in birds fed 15 and 20 percent Azolla diets. As well as Naghshi *et al.* (2014)^[15] and Basak *et al.* (2002)^[11] reported that the highest dressing percentage was observed in the birds fed with 5 percent level of Azolla.

Chemical composition of breast and thigh muscle

The effect of dietary incorporation of Azolla meal on meat composition in breast and thigh muscle is presented in Table 2 and Table 3. The results obtained regarding the chemical composition in breast muscles revealed that the percent moisture, dry matter, protein, ether extract and ash content under each treatment were 74.24, 74.55, 74.52 and 74.62 percent, 25.61, 25.48, 25.59 and 25.46 percent, 22.46, 22.59, 22.37 and 22.68 percent, 2.54, 2.43, 2.39 and 2.45 percent, 1.46, 1.54, 1.44 and 1.49 percent in T₀, T₁, T₂ and T₃ group, respectively. Statistically the differences in proximate composition of breast muscle of broiler meat were non-significant, which indicated that though the different levels of Azolla meal in the diet improved feed conversion efficiency but it did not affect the meat quality.

Table 1: Effect of feeding Azolla meal on carcass traits of Japanese quail

Carcass traits (%)	Treatments				Mean ± SE	CD @ 5%
	T ₀	T ₁	T ₂	T ₃		
Live body weight (g)	202.27 ^b	208.36 ^b	218.90 ^a	221.55 ^a	212.77 ± 2.781	8.571
Hot carcass weight (g)	151.25 ^b	156.73 ^b	165.90 ^a	168.54 ^a	160.56 ± 2.130	6.564
Dressing (%)	74.77 ^b	75.22 ^b	75.78 ^a	76.08 ^a	75.46 ± 0.175	0.542
Breast (%)	17.15 ^c	17.23 ^{bc}	17.67 ^{ab}	17.95 ^a	17.50 ± 0.153	0.472
Giblet (%)	4.09 ^d	4.23 ^c	4.46 ^b	4.81 ^a	4.40 ± 0.019	0.059
Drumstick (%)	11.82	11.77	11.83	11.70	11.78 ± 0.014	NS
Thigh (%)	18.16 ^c	18.19 ^c	18.71 ^b	18.88 ^a	18.48 ± 0.021	0.067

The results obtained regarding the chemical composition in thigh muscles revealed that percent moisture, dry matter, protein, ether extract and ash content under each treatment were 77.41, 77.34, 77.44 and 77.42 percent moisture, 22.54, 22.62, 22.55 and 22.51 percent dry matter, 20.36, 20.41, 20.33 and 20.29 percent protein, 2.62, 2.58, 2.59 and 2.64 percent ether extract, 1.56, 1.55, 1.58 and 1.58 percent ash in T₀, T₁, T₂ and T₃ group, respectively. Statistically the differences in proximate composition in thigh muscle of quail

meat in different levels of Azolla meal in the diet were non-significant.

Present investigated results were in agreement with the findings of Sharma (2014) [10] reported that proximate composition of broiler meat i.e. dry matter, crude protein, crude fiber, crude fat, total ash, acid insoluble ash, ether extract, nitrogen free extract estimated from the muscle samples of control and different treatments with Azolla substitution at different levels exhibited no significant ($p < 0.05$) difference between the treatments.

Table 2: Effect of different levels of Azolla feeding on breast muscle composition (%) of Japanese quail

Treatments	Parameters				
	Moisture	Dry Matter	Protein	Ether Extract	Ash
T ₀	74.24	25.61	22.46	2.54	1.46
T ₁	74.55	25.48	22.59	2.43	1.54
T ₂	74.52	25.59	22.37	2.39	1.44
T ₃	74.62	25.46	22.68	2.45	1.49
Mean	74.48	25.54	22.53	2.45	1.48
± SE	0.096	0.087	0.080	0.050	0.012
CD @5%	NS	NS	NS	NS	NS

Table 3: Effect of different levels of Azolla feeding on thigh muscle composition (%) of Japanese quail

Treatments	Parameters				
	Moisture	Dry Matter	Protein	Ether Extract	Ash
T ₀	77.41	22.54	20.36	2.62	1.56
T ₁	77.34	22.62	20.41	2.58	1.55
T ₂	77.44	22.55	20.33	2.59	1.58
T ₃	77.42	22.51	20.29	2.64	1.58
Mean	77.40	22.56	20.35	2.61	1.51
± SE	0.094	0.058	0.054	0.059	0.014
CD @5%	NS	NS	NS	NS	NS

Blood serum biochemical profile

The mean serum parameters estimated at the end of sixth week of age are given in Table 4.

Serum Total Protein

The mean serum total protein levels at sixth week of age were 3.41, 3.63, 3.70 and 3.84 g per dl in groups T₀, T₁, T₂ and T₃ respectively with an overall mean of 3.65 g per dl. Statistical analysis revealed that no significant difference found within different treatment groups. Results reported by research workers were in agreement with present results. Najim Yonis S. *et al.* (2020) [6] and Raseena (2006) [9] observed serum total protein of 3.29, 2.97, 3.37 and 3.02 g/ld in Japanese quail layer feed with diet containing Azolla at 0, 1.5, 3 and 4.5 percent level at twenty sixth weeks of age.

Serum Cholesterol

It was revealed that the serum total cholesterol levels at the end of sixth week of age for groups T₀, T₁, T₂ and T₃ were 185.23, 177.14, 165.38 and 161.44 mg per dl respectively with an overall mean of 172.33 mg per dl. Significantly ($p < 0.05$) higher values were obtained with control group than

T₃ group. It showed a decreasing trend in groups were higher cholesterol level found in control group followed by T₁, T₂ and T₃. The reduction in average serum total cholesterol in the treatment T₃ is due to the highest level (7.5 %) of Azolla in the feed. The results reported in the present investigation were supported and in agreement with results recorded by Raseena (2006) [9] and Najim Yonis *et al.* (2020) [6] conducted experiment to know the effect of the use of different levels of Azolla to male broilers diets at levels 5, 10, 20 and 30 % for T₂, T₃, T₄ and T₅ respectively and were compared with the control treatment T₁, which is free of Azolla. There were significant decrease ($p \leq 0.05$) in cholesterol level in blood plasma for the treatment of 5% Azolla compared to 10% and 20% Azolla treatments, respectively.

Serum Uric Acid

The mean serum creatinine values were 0.66, 0.63, 0.63 and 0.62 mg per dl in dietary groups T₀, T₁, T₂ and T₃ respectively with an overall mean of 0.63 mg per dl. Statistical analysis revealed no significant difference. Similar findings reported by Najim Yonis S. *et al.* (2020) [6] and Raseena (2006) [9] observed that serum uric acid of 3.10, 3.27, 3.31 and 3.27

respectively with 0, 1.5, 3 and 4.5 percent Azolla meal in diet of layer quail at twenty sixth week of age. The values were statistically comparable among different treatments. And Eman Ramadan Kamel and Eman Hamed (2021) [3] revealed the results uric acid were significantly ($p < 0.05$) decreased in all broilers fed with dried Azolla.

Serum Creatinine

The mean serum uric acid values were 2.19, 2.16, 2.13 and 2.28 mg per dl in dietary groups T₀, T₁, T₂ and T₃ respectively

with an overall mean of 2.19 mg per dl. Statistical analysis revealed no significant differences. Similar findings reported by Najim Yonis S. *et al.* (2020) [6] there were no significant differences between the control treatment and experimental treatments in biochemical characteristics of blood plasma of creatinine. Whereas Eman Ramadan Kamel and Eman Hamed (2021) [3] revealed that results creatinine were significantly ($p < 0.05$) decreased in all broilers fed with dried Azolla.

Table 4: Effect of Azolla meal powder on blood serum biochemical profile in Japanese quail

Treatments	Parameters			
	Total Protein (g/dl)	Cholesterol (mg/dl)	Creatinine (mg/dl)	Uric acid (mg/dl)
	3.41	185.23 ^a	0.66	2.19
T ₁	3.63	177.14 ^b	0.63	2.16
T ₂	3.70	165.38 ^c	0.63	2.13
T ₃	3.84	161.55 ^d	0.62	2.28
Mean ± SE	3.65 ± 0.022	172.33 ± 0.332	0.63 ± 0.014	2.19 ± 0.016
CD @ 5%	NS	1.023	NS	NS

Conclusion

The dressing percentage, breast percentage, thigh percentage, giblet percentage and total serum cholesterol was significantly higher in treatment feeding with 7.5 percent level of Azolla meal.

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